# Understanding the Impacts of Climate Change on Water Access and the Lives of Women in Tharparkar District, Sindh Province, Pakistan: A Literature Review, 1990-2018

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**Executive Summary**

This report assesses how and why women in poor, rural communities in Tharparkar District, Sindh Province, Pakistan are disproportionately impacted by and must adapt to climate change, and how the effects on these women can be mitigated. It attempts to identify the factors causing women's vulnerability to climate change, examine how the combination of factors compounds women's degree of vulnerability, and suggest gender-sensitive policies to reduce women's vulnerability to climate change in Tharparkar District.

Women are disproportionately impacted by climate change and related natural disasters because of their involvement in farming activities, burden of responsibilities at home, and disadvantaged position within society. Women comprise the majority of the agricultural labor force in Tharparkar District, but are underpaid, undervalued, and overworked. Decreased water availability due to climate change affects women working in agriculture. Drought, saline water intrusion, and unpredictable rainfall results in women working longer to collect water, leaving them with less time to earn income outside the home. Crop productivity plummets as a result of unreliable monsoon rains. As the quantity and quality of food and water available to families is reduced, women's share of nutrition decreases more than other family members' portion. Women's poor nutritional status is a key factor in their ability to cope with risk. So too are their marginalization in their own communities, exclusion from politics, denial of access to education and basic services, and experience of high rates of violence.

A women's disadvantaged position in society is made worse by the challenges posed by climate change. This report assesses several policy options and provides recommendations to lessen the impacts of climate change on women in rural Tharparkar District, such as improving agricultural practices, initiating social protection programs, and teaching technical and vocational skills. Recommendations include the evaluation and monitoring of environmental migration within Pakistan due to climate change and the implementation of policies to support communities of origin and itinerant peoples. This report recommends investment in capacity-

building projects to improve institutional coordination, grassroots organization, and communication across all levels of governance.

Analysis of the impacts of climate change on women in Tharparkar District is a useful case study for comparing the lives and condition of women living in poverty around the world. This report highlights the importance of mainstreaming gender in any future climate change or development policies. Without improving the lives of poor women in rural communities in Tharparkar District, Pakistan cannot achieve its economic goals or build resilience to climate change.

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**RESEARCH QUESTIONS**

How and why women in poor, rural communities in Tharparkar District, Sindh Province, Pakistan are disproportionately impacted by and must adapt to climate change, and what these impacts and the issues associated with gender inequality mean for Pakistan's greater stability and achievement of its national climate goals.

## I. INTRODUCTION

Rural Sindh Province, Pakistan is dominated by the Thar Desert in the southeast, along the border with India. This area includes Tharparkar District, one of twenty-nine districts in Sindh. Tharparkar District is the poorest and most remote. Communities in Tharparkar District rely on agriculture. Women play a significant role in farming and are also responsible for the household, meal preparation, child-rearing, healthcare, and water collection. In Tharparkar District, women are marginalized and disenfranchised. Strict social structures, the influence of powerful elites, landholding practices, and cultural and religious constraints leave women with little power. Climate change increases the burden of responsibility for women in Tharparkar District. Social, economic, and cultural barriers, in combination with ineffective policies and implementation, result in the exclusion of women from the decision-making process.

This report identifies the vulnerabilities of women in Tharparkar District to climate change and its impacts and evaluates women's access to the resources, services, and facilities necessary to adapt. This report explores the historical and current role of women in Tharparkar District, as well as local climate and weather trends, economic conditions, and the broader implications for Pakistan's development. It assesses several policy options and provides recommendations to improve agricultural practices, initiate social protection programs, and teach technical and vocational skills. Most importantly, this report recommends investment in capacity-building projects. These projects will have a positive effect on the social, cultural, and economic status of women. As women build resilience against climate change and its related disasters, so too will communities and the region at large.

## II. BACKGROUND

### Environmental, Economic & Social Indicators in Pakistan

Pakistan is a diverse country: culturally, economically, and geographically. It occupies over 88,000 square kilometers in some of the harshest terrain in the world. The country is challenging to characterize – vast differences in topography support a wide range of ecosystems and climatic zones which in turn foster distinct socio-economic conditions.

Pakistan's climate is generally hot and dry near the coast and along the lowland plains of the Indus River Valley. Temperatures cool in the northern, mountainous portions of the country. The country is bisected by the fertile Indus River Valley, which supports the economic heart of Pakistan (See Figure 1). Scattered between the Hindu Kush mountain range in the north, desert to the east, and the Indus River in the center are small villages reliant on subsistence farming (See Figure 2). The Indus River, the largest natural source of irrigation in the world, supports the majority of Pakistan's population, which was the seventh largest in the world in 2014 at 185.5 million[1]. As of 2016, that number grew to 202 million. In 2019, the population was a staggering 204.6 million[2].

Although Pakistan contributes only a small percentage of global greenhouse gas emissions, it is one of the countries most severely impacted by the effects of global climate change. It consistently ranks in the top 10 on Germanwatch's Global Climate Risk Index (See Figure 6). Climate change costs Pakistan's economy almost $5 billion a year, approximately 5% of the country's gross domestic product (GDP)[3],[4]. Since 2015, climate change-related disasters have displaced more than 10 million people across Pakistan[5].

Pakistan faces many environmental challenges exacerbated by population growth and overpopulation, including deforestation, loss of biodiversity, air pollution, access to safe

[1] World Bank, 2019
[2] CIA World Factbook Pakistan, 2019
[3] Kompas et al., 2018
[4] Burke et al., 2015
[5] Climate Emergency Institute, 2017

drinking water, and the impacts of a changing climate[6]. Communities reliant on Pakistan's natural resources are particularly vulnerable.

Climate change has a clear social, environmental, and economic impact in Pakistan. The effects of climate change are more pronounced given a large percentage of the population's reliance on nature for basic survival. The country's high population growth rate and density, coupled with widespread poverty, keep it from adapting quickly to the impacts of climate change[7]. Economic losses upwards of $4.5 billion are anticipated as crop productivity and livestock yields suffer under higher temperatures, lack of water, and changing precipitation patterns[8,9].

Average annual temperatures in Pakistan have increased by 0.6 degrees Celsius over the last century[10]. On average, that is an increase in temperature around 0.08 degrees Celsius per decade. Precipitation trends are also a source of concern. They reveal an increase in annual precipitation over the last century, but average monthly rainfall has not increased proportionally[11,12]. Rainfall during the winter and spring months has decreased, while rainfall during monsoon has increased intermittently. On the whole, Pakistan is getting warmer and rainfall patterns are becoming more unpredictable.

Climate change severely affects the portion of the population reliant on agriculture. In 2010 and 2011, 74.2% of working women were employed in the agricultural sector[13]. In 2018, 72.4% of Pakistani women were employed in agriculture[14]. Although women across Pakistan are marginalized due to various cultural, social, and religious constraints, they play a large role in farming activities. This includes sowing, planting, transplanting, weeding, harvesting, threshing,

[6] Pakistan EPA, 2005
[7] Khan et al, 2016
[8] Ahmed & Schmitz, 2011
[9] FAO, 2018
[10] Khan et al., 2016
[11] Khan et al., 2016
[12] UNDP, 2006
[13] Hamid & Afzal, 2013
[14] World Bank, 2018

drying, storage, transport, and marketing. To maintain livestock, women collect fodder, feed and groom the animals, and process and sell products such as cheese, butter, yogurt, dung cakes, etc.[15].

Climate change will impact all society. Poor women living in rural areas are expected to suffer most. Studies of natural disasters and their aftermath reveal how women are the first and largest group to be affected. During the floods in Pakistan in 2010, 713,000 women between the ages of 15 and 49, including 133,000 pregnant women, were affected. Some lost their homes or became ill. More than 500 women and children died. The following year, 3.6 million women in Sindh were displaced because of drought, flooding, other natural disasters, or economic insecurity[16].

The consequences of climate change impact women's employment in Pakistan. Women are paid less than men and rely more on crops as a source of income and nutrition. They disproportionately bear any loss in value or productivity due to climate change. Shifting climate and weather patterns threaten to endanger women's lives and livelihoods. Women's important economic roles, particularly in agriculture, must be considered when addressing policy or development objectives.

***Environmental Protection in Pakistan***

The National Ministry of Climate Change was established in 2012. The first document published by the new ministry was a draft National Climate Change Policy, which set out to address the impacts of climate change. The Ministry is particularly concerned with extreme weather events and has been working to put in place adaptation and mitigation strategies, disaster preparedness measures, as well as capacity-building and institutional resilience initiatives. Capacity-building, in the case of the national government of Pakistan, is defined as the development and strengthening of human and institutional resources (skills, knowledge,

[15] Hamid & Afzal, 2013
[16] Skirkat Gah, 2011

personnel, equipment, communication, infrastructure, and other assets) necessary to fulfill its mission and achieve its goals competently or to greater effect. This includes operating at a larger scale to reach a larger audience more efficiently[17]. Since 2013, the Ministry has been developing a framework for implementing national climate change policy.

The Pakistan Environmental Protection Agency (EPA) was established in 1997. It has the responsibility to undertake research and technology development to prevent pollution, protect the environment, and promote sustainable development[18]. The Sindh provincial division of the Pakistan EPA has been ineffectual since its inception. It lacks the necessary personnel, administrative power, or financial or technical capacity to successfully prevent or clean up pollution or to support communities in the wake of a natural disaster. Due to frequent changes in leadership at the local and national level, the Pakistan EPA also lacks clear political priorities or direction.

**Environmental, Economic & Social Indicators in Sindh Province, Pakistan**

Sindh is the third largest province in Pakistan by area and second largest province by population. It is divided into 29 districts (See Figure 3). It is bordered by Baluchistan to the west, Punjab to the north, the Indian states of Gujarat and Rajasthan to the east, and the Arabian Sea to the south. The landscape of Sindh Province consists mostly of alluvial plains flanking the Indus River, but also encompasses the Thar desert along the border with India and the Kirthar Mountains in the west (See Figure 4).

Due to its coastal access, Sindh Province has become a major center for economic activity in Pakistan. The economy is dominated by that of Karachi, the capital city of the province and the largest city and economic capital of the country. Sindh has a highly diversified economy, ranging from manufacturing and industry (cement, plastics, etc.) to finance, both centered in and around Karachi, to a substantial agricultural base along the Indus River[19].

[17] UNDP, 2009
[18] Pakistan EPA, 2019
[19] Sindh Board of Investment, 2018

Cotton, rice, wheat, sugar cane, bananas, and mangoes are the most important crops grown in Sindh. The province produces 35% of the rice, 28% of the sugarcane, 12% of the wheat, and 20% of the cotton in Pakistan. Sindh Province has significant natural gas, petroleum, and coal resources and produces the most natural gas of any province in Pakistan[20,21]. It contributes one-third of the country's GDP, mostly from economic activity in Karachi, and encompasses 18% of its total landmass[22].

Sindh Province has a population of 47.9 million people. Slightly more than half the population live in urban areas. As recently as 1998, more than half the population lived in rural areas[23]. This shift illustrates how quickly people are moving into cities like Karachi and Hyderabad. About one in four Pakistanis live in Sindh Province. One-third of the province's population lives in the Karachi metropolitan area. Sindh Province is notably more urban than Pakistan overall[24]. Population growth has accelerated to around 2.4%, with an approximate gender ratio of 1.09 men to every woman. By some estimates, there are 2 million more men than women in Sindh Province[25].

About half of the population of Sindh Province are ethnic Sindhis, who self-identify as a distinct people and culture, and have their own language. However, ethnic Sindhis are a minority in Karachi. The majority of ethnic Sindhis live in rural areas of the province where 75% of the population live in poverty. In urban areas of Sindh Province, around 11% of the population live in poverty[26].

[20] World Bank, 2014
[21] CPCS, 2010
[22] FAO, 2015
[23] Government of Pakistan, 1998
[24] Pakistan Bureau of Statistics, 2017
[25] Pakistan Bureau of Statistics, 2017
[26] Pakistan Bureau of Statistics, 2018

Ninety-three percent of the population in Sindh Province is Muslim, although the majority of Hindus living in Pakistan live in Sindh Province. Hindus account for 6.5% of the population[27]. Pakistani Sindhis are mostly Muslim, while Indian Sindhis are predominantly Hindu. This division arose with the partitioning of India by the British in 1947. After gaining independence, there were active secessionist and nationalist movements in Sindh province and amongst the Sindhi population to establish the province as an independent nation. Some of this sentiment persists to this day as Sindhis are underrepresented in their own government, both in the province and at a national level. In NGO surveys, Sindhis also report being mistreated by the powerful Pakistani military and civil bureaucracy[28].

Historically, Sindh Province has suffered from droughts, earthquakes, floods, cyclones, and other natural disasters. In 2010, floods displaced 7.2 million people from nearly 12,000 villages. The economic impact was estimated at $4.4 billion[29]. Flooding in 2011 harmed 38,347 villages and displaced 9.3 million people with nearly 500 deaths attributed to the rising waters[30]. Persistent drought from 1998 to 2002 affected 1.4 million people, 12.5 million acres of crops, and 5.6 million cattle, leading to food scarcity, malnutrition, and disease[31]. Recurrent drought conditions have also exacerbated problems associated with the depletion of groundwater resources, desertification, and saltwater intrusion.

***Environmental Protection in Sindh Province***

The 18th Amendment to the Constitution of Pakistan was passed in 2010. Power was transferred to the provincial government, giving local authorities more autonomy. The Provincial Disaster Management Authority (PDMA) is responsible for formulating and implementing climate change and natural disaster-related policies in Sindh Province. PDMA is in charge of conducting vulnerability analyses in different parts of the province, as well as providing technical assistance, climate education, and community training pre- and post-

[27] Federation of American Scientists, 2015
[28] Verkaaik, 2016
[29] Government of Sindh, 2016
[30] Government of Sindh, 2016
[31] Government of Sindh, 2016

disaster[32]. PDMA and the Sindh Province Irrigation Department collaborated on the Sindh provincial government's resilience project. This project includes institutional support, budget management and oversight, and infrastructure construction or improvement. With the support of both the World Food Program and Focus Humanitarian Assistance Pakistan (FOCUS-Pakistan), PDMA has launched a community-based disaster reduction and school safety project[33].

In 2016, the Sindh provincial government set up a new department under the jurisdiction of the EPA called the Climate Change, Environment and Coastal Development Department. It was meant to consolidate responsibilities related to environment and climate change. However, jurisdictional overlap complicates the issue of environmental protection and remediation within Sindh Province, especially within Tharparkar District where drainage systems belong to the local government, industries are governed by their own agency, and coastal land is owned by the forestry department[34,35]. While authorities argue over jurisdiction, the condition of the environment deteriorates further.

## Environmental, Economic & Social Indicators in Tharpakar District

### *Environmental Indicators in Tharparkar District*

#### Historical Climatic Conditions

Tharparkar District is one of the largest in Pakistan, encompassing nearly 20,000 square kilometers on the southeastern border with India. The area is hot, arid, and highly vulnerable to drought (See Figure 5). Annual rainfall is less than 200 millimeters[36]. The Thar Desert is defined by extremes. In the summer, it is very hot during the day with cool nights. In winter, days are mild and nights are cold. The sandy terrain warms during the day but does not retain heat at night.

[32] PDMA-Sindh, 2015
[33] Whole Foods Program, 2016
[34] Ahmed, 2016
[35] IISD, 2016
[36] Adnan et al., 2015

Drought struck Tharparkar District in 2013 and again in 2017. The first period of drought reached its most critical stage between March and August of 2014. The more recent drought has continued into 2019. The population, which is reliant on rainfall to support agriculture and livestock, suffers from food insecurity and chronic malnutrition. High rates of neonatal mortality and disease, as well as the death of livestock and the loss of crops, have led to an increase in forced migration within the district and across Sindh Province.

Tharparkar District does not have a natural system of irrigation. Rather, it depends on monsoon rainfall to support farming, pastured livestock, and the many small villages that dot the harsh landscape. Monsoon is the rainy season of Pakistan and Tharparkar District. It is a critical time for agriculture, with implications for industry, drinking water resources, energy generation, and human health. Tharparkar District receives over 60% of its mean annual rainfall during the summer monsoon season, which traditionally spanned the months of June to September. During monsoon, 75% of precipitation was concentrated in the months of July and August[37]. There are periods, sometimes several consecutive years, where the Thar Desert receives minimal to no rainfall. This was the case between 1999 and 2001, and again from 2014 to the present day[38].

The monsoon winds from the Bay of Bengal lose their moisture before they reach Tharparkar District. The rain-laden monsoon winds from the Arabian Sea pass over the desert as well; however, there are no high mountain ranges to force precipitation. Weaker monsoon winds mean less water for Tharparkar District[39]. Rain-fed rivers or streams fill quickly during monsoon and often over-top their banks, causing flash flooding. These ephemeral bodies of water are not reliable resources for local communities. Any river that winds through the desert is seasonal. And, when it does flow, it sinks into the sand all too quickly. As a result, Tharparkar District remains dry for most of the year. Outcroppings of date palms trees cluster where the water table is close to the land surface. Villages are often found in these small oases as well.

[37] Pakistan Meteorological Department, 2018
[38] Torres, 2015
[39] Wang, 2011

Temperatures and rainfall are directly linked to agricultural production and other important aspects of daily life in Tharparkar District, such as water access and potability. Changes in these trends and the prediction of future trends are essential for the district, as well as the country as a whole, where both the local and national economies are reliant on agriculture. Crop failure, due to extreme temperatures and unpredictable rainfall patterns, has a lasting impact across social and economic strata. Farmers rely on their crops for food and as a source of income; therefore, it is doubly important to monitor any temperature or rainfall variations.

Temperature and rainfall data from Mithi, a town in the Thar Desert, provide context. The most commonly considered indicators of climate change are rising air temperatures and increasing evaporation and evapotranspiration rates, leading to higher levels of atmospheric water vapor and changes in seasonal rainfall patterns. This is observed in the case of Mithi. Data from a study by Hanif & Ramey (2014) charts the mean monthly temperature (in degrees Celsius) over the year and mean monthly rainfall from 1961 to 1990 and 1981 to 2010 (in millimeters per month) (See Figure 8 & Figure 9).

Hanif & Ramey (2014) report mean monthly temperatures of approximately 17 degrees Celsius during the month of January. Temperatures climb to their peak in May and June, when temperatures reach a maximum of nearly 40 degrees Celsius. Minimum monthly temperatures range from less than 5 degrees Celsius (January) to just under 30 degrees Celsius (June). Maximum monthly temperatures range from over 25 degrees Celsius (January) to nearly 40 degrees Celsius (May). The historical variability of temperature in Mithi, and across Tharparkar District, makes it more difficult to characterize what changes to expect under climate change. The historical record also presents compelling evidence of residents' pre-existing knowledge of and adaptability to unpredictable weather patterns.

Similarly, mean monthly rainfall in Mithi is irregular. Monsoon lasts from June to September, but sometimes extends from May to October. Between July and September from 1961 to 1990,

Mithi received over 200 mm of rain. Between those same months from 1981 to 2010, Mithi received over 300 mm of rain (See Figure 9). The rest of the year, Mithi receives a negligible amount of precipitation. Tharparkar District is entirely reliant on five months or fewer of rain to sustain agriculture for the remainder of the year. Water supplies, both surface and groundwater resources, also depend on monsoon rains.

**Projected Changes in Local Climatic Conditions**

Projected temperature increases across Pakistan are significantly higher than the global average. The Intergovernmental Panel on Climate Change (IPCC) projects a global average temperature increase of 3.7 degrees Celsius by 2100 under the highest emissions pathway (See Figure 11)[40]. An average increase of 4.9 degrees Celsius is projected for Pakistan under the same scenario. The most severe temperature increases are predicted in northern Pakistan, in excess of 5 degrees Celsius (See Figure 12)[41]. Tharparkar District will experience warming between 0.5 and 1.5 degrees Celsius (See Figure 10). The projected rise in annual maximum temperature is estimated at 5.24 degrees Celsius[42]. On average, winter temperatures are predicted to increase more than in summer (See Table 1).

Great uncertainty surrounds projections of future precipitation trends in Pakistan, especially in Tharparkar District, due to complications inherent in modeling the South Asian monsoon and the oscillation of El Niño. An increase in future precipitation is supported by the research; however, this does not account for local decreases in precipitation that would impact already dry areas of the country. As with global projections, dry areas will get drier and wet areas will get wetter.

Studies of spatial rainfall across the Thar Desert reveal troubling trends. Rainfall has decreased in parts of Tharparkar District and shifted in others. The Thar Desert, and Tharparkar District as a whole, are already extremely vulnerable to drought. The Thar Desert is one of the most

[40] ADB, 2017
[41] World Bank Climate Change Knowledge Portal – Pakistan, 2019
[42] World Bank Climate Change Knowledge Portal – Pakistan, 2019

vulnerable regions, both socially and environmentally. Temperatures in Tharparkar District have risen, and rainfall has been intermittent. Conditions are unlikely to improve, even under IPCC scenarios where global temperature increases are constrained. High temperatures, severe rainfall events, and shifting monsoon seasonality will only become more unpredictable in the future. Communities in these areas are at risk.

Hanif & Ramey (2014) projected temperature and rainfall scenarios for the town of Mithi, the district capital of Tharparkar, out to 2040. Every decade, from 2011 to 2020, 2021 to 2030, and 2031 to 2040, average, minimum, and maximum temperatures are projected to increase (See Table 1). Annual, winter, spring, summer, and fall temperatures will all rise. Between 2011 and 2020, projected maximum summer temperatures are expected to rise 5.14% from maximum summer temperatures recorded between 1981 to 2010 (See Table 1). This temperature increase represents a change of approximately 2 degrees Celsius (See Figure 14). Between 2031 and 2040, maximum summer temperatures are projected to rise nearly 5 degrees Celsius. Minimum winter temperatures are projected to increase by 9.93% between 2011 and 2020 as compared to minimum winter temperatures recorded between 1981 and 2010. Mean minimum winter temperatures in Mithi are projected to rise 2 degree Celsius by 2040 (See Figure 13). As Tharparkar Districts gets hotter, human health, crop productivity, livestock, and water access will all be adversely affected.

Warmer temperatures will also shift rainfall patterns over Tharparkar District. More heat will be retained at the land surface and speed evapotranspiration and evaporation. Moisture will be held in the atmosphere, causing rainfall to decrease in some regions and increase in others. Hanif & Ramey (2014) projected the average amount of rainfall in Mithi out to 2040. Between, 1981 and 2010, Mithi received an average of nearly 250 mm of rain during monsoon season (See Figure 15). By 2040, Mithi is projected to receive slightly less than 250 mm of rain. Although this is not a drastic change from average rainfall between 1981 to 2010, it is important to consider when and how Mithi will receive these 250 mm. Consistent, reliable rainfall is typical for monsoon season. Under climate change, rainfall events will become more

erratic and severe, often dumping large quantities of precipitation over a short period of time. These extreme weather events do not support agriculture or replenish groundwater resources as well as the continuous monsoon rains of the past. Perhaps most telling are the projections by Hanif & Ramey (2014) for average rainfall in Mithi during winter and spring (See Figure 16). Between 1981 and 2010, average rainfall during winter was a little over 6 mm. By 2040, average winter rainfall is projected to fall to less than 6 mm. These changes may be subtle, but they denote the persistence of drought conditions in Tharparkar District for at least half the year.

Rainfall patterns are variable and becoming more erratic because of climate change[43]. This is illustrated by a comparison of monthly rainfall in 2013 and 2014 to average rainfall in Sindh Province. There was a rainfall deficit around 30% between March 2013 and February 2014[44]. In May 2013, Tharparkar District received 100% less rain than expected during average monsoon conditions. Soon after, in June of 2013, the district received 292% more rain than average (See Table 2). This deviation from average monsoon rainfall conditions is an example of the local scale of climate change impacts. 2014 was even worse for Tharparkar District. From March to September 2014, Tharparkar District received between 17% and 99% less rainfall than during average monsoon conditions.

Climate change exacerbates pre-existing environmental problems. In 1947, Pakistan's relatively small population of 30 million people meant the amount of water available per person, 5000 cubic meters per person, classified the country as water-rich. Today, the amount of water available per person, less than 1000 cubic meters per person, makes Pakistan a water-scarce country[45,46]. A combination of overpopulation and climate change has reduced the amount of water available. In the future, the total quantity of water will continue to decline, exacerbating water scarcity. Water availability will become more erratic, increasing seasonal stress. Rising

[43] Sattar, 2014
[44] JSWO, 2014
[45] Warraich, 2011
[46] Young et al., 2019

temperatures will accelerate evaporation and evapotranspiration rates, increasing water requirements for crops and other water demands and further complicating water allocation.

Water shortages, drought, and famine plagued Tharparkar District for the last decade. In Tharparkar District, and specifically in the Thar Desert, water has always been scarce (See Figure 17). Thar is the world's most populated desert ecosystem with 1.5 million people living in approximately 2,300 villages or settlements. Water stress has been made worse by overgrazing, water-intensive agricultural practices, and groundwater depletion. Farmers and families reliant on wells are less likely to be aware of or adapt water-related behaviors to changes in temperature or rainfall. Reliance on groundwater for irrigation or household chores is unsustainable.

In Tharparkar District, groundwater is polluted with naturally-occurring arsenic and fluoride from the surrounding strata. A campaign to reduce the prevalence of diseases like dysentery, caused by bacteria found in surface water, promoted the digging of wells; however, neither the government nor the international affiliates made sure the groundwater was free of contaminants. Seventy-nine percent of water in the Thar Desert is brackish and high in total dissolved solids (TDS). Only 21% of groundwater is suitable for human consumption[47]. Excess fluoride causes skeletal fluorosis, a major public health problem. Sufferers endure bent bones, calcified joints, and dental issues. These symptoms are often misdiagnosed as polio or rickets. The World Health Organization recommends limiting fluoride to 1.5 parts per million (ppm) in potable water. According to the U.S. Environmental Protection Agency, the maximum contaminant level of arsenic is 0.01 ppm. Arsenic concentrations in groundwater exceeded permissible levels between 2 and 235 times[48]. In some villages in Tharparkar District, drinking water contains 15 ppm of fluoride[49].

[47] Kumar, 2017
[48] Brahman et al., 2016
[49] Kumar, 2017

**Water Access & Drought in Tharparkar District**

Drought is a slow onset event. Its effects can be less obvious as they accumulate over time. Consequently, drought can impact more people over a larger area than other natural disasters. According to the Pakistan Meteorological Department, drought is defined as, "an extended period of months or years when a region notes deficiency in its water supply"[50]. Below-average amounts of precipitation negatively impact the local ecosystem and agriculture. Droughts can be meteorological, agricultural, hydrological, or socio-economic. Meteorological drought is defined by the severity and duration of the dry season. Agricultural drought is measured by the impacts to food production and farming. Hydrological drought is associated with the effects of precipitation, or lack thereof, on water supplies. Finally, socio-economic drought occurs when the demand for a good exceeds its supply.

According to the Jaggarta Organization, Pakistan's worst drought of the last fifty years occurred between 1998 and 2002[51]. It began with the El Niño Southern Oscillation of 1997. Between 1871 and 1988, eleven of Pakistan's twenty-one droughts occurred in El Niño years[52]. Droughts are associated with high-pressure systems, winds that carry continental rather than oceanic air masses. While El Niño is strongest in the equatorial Pacific, it affects precipitation patterns all over the world[53]. El Niño conditions are already in evidence and predicted to strengthen between April and June 2019[54].

Climate change is one of the causes of drought. It changes patterns of precipitation and the intensity of weather events. Monsoon now occurs in September, instead of July and August, and heat waves, floods, and cyclones are more severe. The demand for natural resources and deforestation can also lead to drought. Overpopulation and a high rate of population growth increase demand for natural resources, such as groundwater or land. The mismanagement of groundwater resources reduces the amount of potable water available and drilling wells can

[50] National Drought Monitoring Centre, 2019
[51] JAGGARTA Organization, 2014
[52] Pakistan Meteorological Department, 2015
[53] Saeed, 2016
[54] ASMC, 2019

contaminate fresh groundwater. The exploitation of other natural resources, such as minerals or fossil fuels, both present in Tharparkar District, further reduces the amount of land and groundwater available. Mining in the Thar Desert by the Sindh Engro Coal Mining Company has contaminated nearby groundwater. It simultaneously de-waters the underlying aquifer[55]. Urbanization and the sprawl of urban areas also draw on water supplies in the surrounding region.

Institutional apathy affects drought conditions as well. Public institutions in Pakistan have a poor record when responding to drought-related crises. The Pakistan Meteorological Department recognizes, "…no organizations dealing with the drought issues exist in Pakistan and the response to drought for the distressed economic and social sector, whenever such situations arose, are taken on emergency and on ad hoc basis"[56]. There is a clear lack of communication and coordination between institutions[57]. Mitigation or development strategies are limited by budget and personnel constraints and lack of political will.

Controversially, the Government of Pakistan classified the drought of 2014 as a socio-economic rather than a hydrological drought[58]. This designation determines the type of response and relief deployed. Only when local and international media and non-profit organizations began to report high rates of infant mortality, disease, and loss of livestock did the government recognize the severity of the situation[59]. In March 2014, provincial authorities raised the classification to "calamity-hit"[60].

According to the Sindh Relief Department, Tharparkar District has been declared "calamity-hit" in 1968, 1978, 1985, 1986, 1987, 1995, 1996, 1999, 2001, 2004, 2005, 2007, 2012, and again in

[55] Guriro, 2016
[56] Pakistan Meteorological Department, 2018
[57] Di Nunzio, 2014
[58] Hashim, 2014
[59] Pakistan Water Partnership, 2014
[60] Hashim, 2014

2018[61]. The reduced or non-existent monsoon season is the main cause of droughts in Tharparkar District. Between 2010 and 2013, Tharparkar District suffered drought-like conditions, although the government was hesitant to classify it as such. In October 2014, the Provincial Disaster Managing Authority (PMDA) declared an "impending emergency"[62]. Historically, Tharparkar District has been declared a disaster area by mid-August if rainfall was below normal levels. In those cases, government assistance in the form of food, water, fodder, and medicine was provided. In 2014, monsoon did not begin until September. Tharparkar District received an estimated 124mm of rainfall as compared to the 190mm in 2013 and the 220mm in 2012[63]. The death toll reached 650 people and 300,000 animals before assistance arrived[64,65] (See Figure 18).

The mishandled response in 2014 demonstrated negligence and lack of governance on the part of national and provincial authorities[66]. For example, the National Disaster Management Authority failed to distribute 60,000 bags of wheat due to an administrative error[67]. The same institution faced harsh criticism during the floods of 2010 for its inability to coordinate aid from international organizations and other domestic agencies. In 2014, local authorities also failed to execute their responsibilities and showed a shocking disregard for the severity of the situation. Local officials blamed higher authorities for the lack of response, while national and provincial authorities claimed district officials alerted them too late[68]. The Tharparkar District's Deputy Commissioner's office maintained they contacted the Sindh provincial government in mid-August, but received no response[69].

[61] Sindh Relief Department, 2018
[62] WFP, 2014
[63] WFP, 2014
[64] Shaikh, 2014
[65] Shaikh & Tunio, 2014
[66] Di Nunzio, 2014
[67] Di Nunzio, 2014
[68] Shaik & Tunio, 2014
[69] Shaik & Tunio, 2014

Following these incidents, several high-profile political leaders visited Tharparkar District. Soon after, two emergency relief packages, totaling $11 million, were approved[70]. Several provincial government officials were removed from office and drought protocols were reformed. Some officials acknowledged that the government failed to deliver food to Tharparkar District in a timely manner; however, most blamed inaccurate reporting of the weather conditions and rates of forced migration, calling it a "media-made disaster"[71].

According to the National Disaster Management Authority, one week after the area was recognized as "calamity-hit", 3,582 tons of wheat, 201 tons of rice, and 1,484 tons of emergency food packs were distributed in Tharparkar District[72]. Soon after, 58 staff were deployed, and 5,318 people were treated at emergency medical camps. In total, 126,790 bags of wheat, 320 bags of rice, and 231 tons of other food items were distributed. Water and fodder were also provided. Fifty medics, paramedics, and doctors from neighboring districts were deployed to Tharparkar District. The army established 6 new medical camps and deployed mobile medical teams and dispensaries. The National Disaster Management Authority estimates that 153,385 people were treated in total. Seventeen mobile veterinary teams treated 4.2 million livestock[73]. By January 2015, these numbers had risen to 625,849 bags of wheat distributed and 446,596 people treated[74].

In September 2018, and again in early 2019, the Government of Pakistan issued drought warnings for Tharparkar District (See Figure 21, 22, & 23). Following last summer's rain-less monsoon season, Tharparkar District is again experiencing severe drought conditions (See Figure 24 & Figure 25). The situation is quickly developing into one of the worst natural disasters Pakistan has faced in recent years. Chronic malnutrition plagues many households in Tharparkar District (See Figure 19 & Figure 20). The lack of water has destroyed food production systems, affecting the health of local communities in turn, particularly women and

[70] Hashim, 2014
[71] Hashim, 2014
[72] NDMA, 2015
[73] NDMA, 2015
[74] NDMA, 2016

children. As many as 71% of households are food insecure. Malnutrition rates among children under five years old and pregnant and lactating women are "alarmingly high", according to the Pakistan office of the International Federation of Red Cross and Red Cross Societies (IFRC)[75].

***Social Indicators in Tharparkar District***

Women constitute roughly 48% of the population of Tharparkar District[76]. Illiteracy is one of the biggest challenges women in Tharparkar District contend with in their struggle for upward mobility and productivity. Tharparkar District's literacy rate is below 20%. For girls, the literacy rate is just 6.9%[77,78]. Rural women have illiteracy rates thirteen times greater than their urban counterparts[79,80]. Oxfam found that a young girl living in rural Sindh Province was 50% less likely to attend school than a young girl in urban Sindh Province[81,82]. The percentage of the adult population in Sindh Province that completed primary education or beyond was approximately 49% in 2017[83]. Fifty percent of the young, school-age population is not enrolled. Only 32% of women in Tharparkar District completed primary school[84]. Of the 4,000 schools in Tharparkar District, 90% are primary. In Pakistan, for every 100 boys receiving primary education, approximately 86 girls are in classrooms as well. This ratio is the gender parity index (GPI). In Sindh Province, the GPI drops to 0.79. In Tharparkar District, the GPI is 0.64[85].

Almost half of Tharparkar District's 1.5 million people are children under eighteen. Of these children, only 165,000 were enrolled in school during the 2013 to 2014 school year. Thirty

[75] IFRC, 2019
[76] Government of Pakistan, 2017
[77] Ijaz, 2012
[78] UNESCO, 2017
[79] Daudani, 2009
[80] ASER, 2012
[81] Oxfam, 2009
[82] Oxfam, 2013
[83] Sindh Bureau of Statistics, 2018
[84] Nazeer et al., 2018
[85] Pakistan District Education Rankings, 2017

thousand of those students advanced beyond primary education. Less than 1,800 students from Tharparkar District enrolled in college and only 350 attended university in 2014[86,87,88].

Lack of education means fewer opportunities for women to improve their lives and well-being. In addition, in rural Sindh Province, women rarely have control over their personal lives. Decisions about health, education, marriage, and employment are all made by male relatives[89]. The GPI of Sindh Province has been declining since 2009. In the 2012 Annual Status of Education Report (ASER) on Pakistan, rural Sindh had the lowest literacy and numeracy rates in the nation[90]. Women's literacy in rural Sindh is significantly lower than men's, 22% to 59%, respectively[91]. The decision to send a girl-child to school is significant, especially when a male family member elects to send that child to a private madrassa. The majority of students attending madrassas in rural Sindh Province are girls. Madrassas are Islamic religious schools, often very conservative and devout. They have been known to propagate patriarchal and oppressive values that further enforce a woman's low status in society and in her own family.

Socially-embedded inequalities determine how severely women are impacted by climate change. Men are not expected to contribute to the home. They work in the fields seasonally to bring in money. A woman, although she may rise first, fetch water, cook, send the children to school, and complete numerous other chores, is not seen as a contributor. Traditional women's work is not considered "work", because it often does not bring in income. Fetching and carrying water is an especially difficult task. The majority of villages in Tharparkar District have no access to clean drinking water. Pipelines do not extend into the most rural areas. At many locations, well water is unsafe for human consumption, but without an alternative, women are forced to use it for drinking, cooking, and sanitation anyway. Reverse osmosis plants have been set up in

[86] Sindh Public Expenditure Review, World Bank, 2017
[87] Ghani, 2016
[88] Government of Pakistan, 2017
[89] Daudani, 2009
[90] ASER Pakistan, 2012
[91] SPDC, 2015

Tharparkar District to try to address the problem; however, they still require women to walk long distances, often multiple times a day, in the extreme heat.

Women bear a disproportionate share of the burden of poverty. They have inadequate access to economic options, social services, and productive assets. In Tharparkar District in particular, there is a shocking lack of health services. Female health workers or trained birth attendants are not available in 69% of the villages[92]. Veterinary services are, on average, 12 km from 50% of rural villages[93,94]. Women depend on their livestock for proper nutrition and income. Without trained veterinary staff to treat sick or injured animals, women are often left with a hard choice to either travel the distance and lose a day of work or suffer financially by killing the animal. When women are employed outside the home, lack of property rights means they are often forced to work less productive land and are excluded from agricultural training services. Women also lack the kind of support networks available to male farmers that might allow them to diversify or increase their resilience[95].

Women will be disproportionately impacted by climate change and related natural disasters because of their involvement in farming activities, which are highly climate sensitive, and social and economic customs that limit their status[96]. In Tharparkar District, women are more involved in the agricultural sector than men. Approximately 70% of the female labor force is engaged in the agricultural sector in rural Pakistan[97]. Women in rural Sindh work 12 to 14 hours per day, on average[98]. They participate in crop cultivation, livestock management, dairy production, forestry, poultry rearing, and fishing, as well as household chores including food preparation, fetching water, firewood collection, supervising and raising children, and care for

[92] SPDC, 2015
[93] WFP, 2017
[94] Khan et al., 2016
[95] FAO, 2015
[96] Hyder & Mahmood, 2015
[97] Makhijani et al., 2015
[98] FAO, 2015

the elderly. Women suffer disproportionately under the impacts of climate change as their already disadvantaged position is made worse.

During droughts or other natural disasters, women work as seasonal laborers. Their wages are lower than men and more likely to go unpaid. Rural women provide 48.2% of the total labor for winter crops and 48.6% of the total labor for summer crops, but only 5% of women living in rural communities own their own land[99]. Land rights are often denied to women as part of their inheritance. Some women are denied their right to own any property, let alone their own land. Even when women have a legal claim to land, social customs often prevent them from taking possession or controlling what the land is used for[100]. Religious constraints hinder women's access to land. This restriction not only limits a woman's ability to feed her family, but also her access to drinking water. Rural women are responsible for collecting water for their communities and families. This chore becomes more onerous in water-stressed areas or in times of drought. In rural Sindh, the Millennium Development Goal (MDG) for 2015 was to achieve a 93% access to drinking water. As of 2013, rural Sindh stands at 65% or less[101]. Between 2004 and 2011, Tharparkar District saw an 11% improvement in access to drinking water[102]. Decreased water availability due to climate change impacts women working in agriculture and the amount of time they spend collecting water each day. Drought, saline water intrusion, and unpredictable rainfall results in women working longer to secure water resources, leaving them with less time earn income outside the home[103].

Women in rural communities face challenges: family law, discrimination in the workplace, prejudice in education, physical or psychological abuse, and social restrictions. Arranged or forced marriages at a young age are still common. Women have no recourse, either in their communities or in the legal system, to protect themselves or their children. Often, women are

[99] FAO, 2015
[100] Hamid & Afzal, 2013
[101] Hamid & Afzal, 2013
[102] Pakistan Millenium Development Goals, 2013
[103] Hamid & Afzal, 2013

encouraged to marry their daughters off at a young age by local religious leaders[104]. Early marriage, teen pregnancy, and lack of family planning are the norm in Tharparkar District. The Pakistan Electronic Media Regulatory Authority recently banned all family planning ads before 11pm, both on television and radio channels[105]. Although many villages lack electricity, so this ban does not affect them directly, the dissemination of information is important. There has been a gradual rise in the awareness of family planning in many villages. Nagarparkar Hospital offers instruction in family planning. In January 2016 alone, 759 women were trained[106]. Although initiatives by the provincial government and the Sindh Rural Support Organization have included women in community-based organizations, the important economic and social role of women is still largely ignored or discredited[107].

In Tharparkar District, patriarchal leadership has institutionalized restrictive behaviors based on gender segregation, household hierarchies, and ideology associating honor and female virtue[108]. Women are marginalized by the feudal system of land ownership, religious fundamentalism, and the government. Women have not been educated about their rights or cannot conceive of enforcing their legal rights within strict family structures. Tharparkar District is characterized by scattered, agrarian villages steeped in local customs, traditions, and tribal laws. These customs control the low status of women. Until women's legal status in recognized, they receive political power, and there exists political will to address issues of gender inequality, there will not be any improvements in the lives or livelihoods of women in Tharparkar District.

**Politics & Women in Tharparkar District**

To address the problems faced by women in rural Sindh Province, the government of Pakistan established the National Commission on the Status of Women (NCSW) in 2000[109]. The NCSW

[104] Khan, 2016
[105] Hashim, 2016
[106] Ghani, 2016
[107] SRSO Annual Report, 2015
[108] Daudani, 2009
[109] NCSW, 2018

examines policies and programs targeting economic development and gender inequality. They review laws and rules affecting the status of women, monitor violations of women's rights, oversee institutional procedures for addressing grievances, and sponsor research related to women and gender studies.

The Sindh Commission on the Status of Women Act was passed in 2015[110]. It examines government policies on women's empowerment and political participation and representation, similar to the NCSW. In the first three months of 2015, 421 cases of violence against women were reported in Sindh Province. NCSW immediately brought several cases before the Supreme Court to advocate for the national prioritization of women's rights in Sindh Province[111]. These actions were groundbreaking in Pakistan; however, the organization often does not advocate for the rights of poor women living in rural communities. Rather, they collaborate with the government and civil society organizations to support women who are considered part of mainstream society and contribute to the national economy. This description does not always include women in Tharparkar District.

Before the Sindh Commission on the Status of Women, the provincial government established the Women Development Department in 1994[112]. This department worked in collaboration with other government departments, for example the Social Welfare Department, to study and address issues of gender inequality. The Women Development Department was meant to initiate and implement women-centric policies and projects for social, economic, legal, and political empowerment. It was also tasked with raising awareness about the rights of women. In 2008, a land redistribution initiative successfully allotted 70% of ownership titles to women[113]. The Department continues to develop more sophisticated gender reform action plans, improve access to finance for disadvantaged women or women who live in rural communities, and lead

[110] Provincial Assembly of Sindh, 2018
[111] Weiss, 2012
[112] Women Development Department, Government of Sindh, 2018
[113] IDRC, 2008

women's empowerment training. They have also begun to map the availability of resources for women across the province[114].

Domestic and international organizations are working to strengthen the role of women in society and the economy in Pakistan and in Sindh Province. The United Nations Women (UN Women) mission, the International Labor Organization (ILO), UNICEF, the International Union for Conservation of Nature (IUCN), the Asian Development Bank (ADB), and the World Bank, along with many others, all have projects focused on women in rural Sindh Province. The Sindh Rural Support Organization, the Social Policy and Development Center, and Leadership for Environment and Development are all working on the problem from within the country.

**Feudalism in Tharparkar District**

In addition to national and local government policies, informal structures within society dictate the role of women in rural Sindh Province. Historically, Tharparkar District was governed by a strong feudal system. Even today, this system remains entrenched. Sindh Province has the highest rates of landlessness and tenancy, and the lowest rates of land ownership. Feudal landlords in possession of more than 100 acres represent only 1% of the province's farmers. This 1% owns 150% more land than farmers with less than five acres, who account for 62% of the province's farmers[115,116].

With the majority of land held by a single individual or family, with the local population employed as farm workers or even bonded laborers, landlords retain massive control over large groups of people. These landowners may win elected office by coercing their tenants, who vote for the landowner out of fear of reprisals. Anyone who does not cooperate may lose their livelihood or be excluded from future benefits. This cycle brings about the advancement of self-serving policies that enable elected officials to prioritize their interests over those of the local population. This system cruelly impacts women.

[114] Government of Sindh, 2014
[115] Yusuf & Hasan, 2015
[116] UNDP, 2016

Feudal lords are representatives of their constituents and tenants. They exercise power over local communities and government. Nepotism and corruption are rampant in this feudal system, as well as in government appointments to key positions. The desire to retain land, influence, and power leads to policies that are often inefficient, self-serving, or cruel. Landowners or tribal chiefs are more likely to pander to extremist groups in their area to cultivate influence or collaborate with criminals to retain power[117]. Civil authorities have taken measures to ensure women remain powerless by shoring up bureaucratic roadblocks. In one instance, civil authorities made it more difficult for women to register on revenue records as tenants, thereby denying women ownership of land and making it more difficult for them to inherit property[118].

Women can legally own land, but state allotment often excludes women[119]. In the land allotment conducted by the Sindh provincial government, women waited months to receive a decision in their favor. As they waited, women could not cultivate the land. They lost several seasons' worth of income and missed the harvest[120]. Imbalanced land distribution is a major component of rural income inequality. Even as women recognize this problem, many are unwilling to challenge the status quo for fear of being alienated from their families. Many also lack the confidence to navigate the legal system[121].

Rural communities, women in particular, lack the information to protect their own rights. The government and multiple non-governmental organizations have launched initiatives to improve the socio-economic status of women by providing access to education and legal counsel. Exclusion and inequality are attributable to economic, social, and cultural structures. There is an unequal distribution of social and human capital and differentiated returns on assets, all of

[117] Yusuf & Hasan, 2015
[118] Hamid & Afzal, 2013
[119] UN Habitat, 2012
[120] Oxfam, 2011
[121] IDRC, 2008

which are determined by public policies like the biased tax system[122]. Resistance by women to policy changes or advantageous programming is primarily due to the high rates of illiteracy among women in rural Tharparkar District. Women are unaware of their rights or unable to demand them. In agricultural communities, women owning land is often seen as weakening the position of their fathers or brothers[123].

***Economic Indicators in Tharparkar District***

Sindh Province has a high rate of rural poverty: 57%[124]. In Tharparkar District, nearly 75% of the population lives in poverty[125]. This rate of multi-dimensional poverty includes variables like literacy, housing, school attendance, and ownership of physical assets (See Figure 7). A feature of the labor force in Tharparkar District is the prevalence of unpaid family contributors who work for a business owned by a member of their household or a relative. Unpaid family laborers constitute approximately 10% of the labor force in rural areas. More than 90% of employed women in rural Sindh Province were unpaid family helpers, as compared to 27% of men[126]. In a study of 300 respondents from rural Sindh, women consistently reported receiving lower wages and having less access to markets[127]. Limited employment opportunities disproportionately affect women living in rural areas and compound societal pressure against their participation outside the household.

Since 2013, there has been a surge in the number of male migrants from rural to urban Sindh Province in search of economic opportunity. Sindh Province's rural economy contributed 37% to the gross regional product in 2013[128,129]. The rural economy in Sindh grew at a rate of 5.5% between 1999/2000 to 2010/2011, which is rapid in comparison to other province's rural economies. Across Pakistan the agricultural sector no longer has the largest contribution to the

[122] UNDP, 2016
[123] SDPI, 2008
[124] SPDC, 2013
[125] Suthar et al., 2016
[126] SPDC, 2013
[127] Ram et al., 2011
[128] Federation of American Scientists, 2015
[129] SPDC, 2013

economy; it has been overtaken by the service sector based in urban areas like Karachi. Agriculture accounts for 38% of national GDP; however, in rural Sindh Province and Tharparkar District the agricultural sector still dominates. The 2014 drought in Tharparkar District resulted in severe damage and economic losses totaling between $1.2 and $2 billion[130].

While restructuring reforms accompanied the delegation of power to the provincial governments under the 18th Amendment, a lack of expertise and coordination between provincial agencies and departments, as well as at the grassroots level, has impeded women's empowerment in Tharparkar District. The concentration of economic activity in urban areas means these populations are prioritized. Statistics from Karachi or Hyderabad demonstrate development is possible, even as under-development in rural areas persists. Social services and infrastructure are highly concentrated in these urban areas as well. Remote areas are neglected. Government programs championing fiscal restructuring, public service delivery, and regulatory reform accelerate human development and economic growth in urban areas. These programs may have an effect on rural areas as well for a time, but any improvements are lost whenever natural or climate change-related disasters occur. Institutional failures and the lack of inter-agency coordination jeopardize progress on women's issues. If proper measures are not taken, Pakistan's expenditure on adaptation is projected to increase by 10% over the next 40 years, from $13 to $40 per capita[131]. With a population of just over 200 million people in 2019, that amounts to $8.2 billion. That number will only increase as the population grows.

[130] LEAD, 2017
[131] WHO, 2012

## III. METHODOLOGY

This report is based on secondary research. It is a synthesis of pre-existing literature on the subject. Academic interest and international concern for the impacts of climate change on Pakistan and the resulting humanitarian crisis have led to an abundance of available research on the topic. Pakistan's vulnerability to climate change leaves it prone to destabilization. Climate change is recognized as a threat multiplier by the global scientific community and the United States military and has been linked to conflict worldwide. Pakistan's sizable vulnerable populations, political instability and regime changes, lack or poor distribution of infrastructure, increased presence of non-state actors, historical tensions between conflicting groups, disputed territory, and increased stress on resources make it less resilient. These conditions leave the country highly susceptible to climate change risk threatening the health, safety, and wellbeing of women. Nowhere is this better illustrated than in Tharparkar District.

Tharparkar District's history of drought, high rate of multi-dimensional poverty, and weak economy make it an outlier in the relatively fertile and prosperous Sindh Province. Issues of gender inequality, human rights, and living conditions persist in many developing countries and are not unique to Pakistan; however, in Tharparkar District they are particularly acute. This makes the district worthy of further study. Confining the scope of the report to the time period between 1990 and 2018 was intended to highlight the discrepancies between the rapid changes occurring across Pakistan, such as economic growth and social upheaval, and the continued marginalization of women.

Relevant scientific literature and data were evaluated to identify factors that affect and compound women's vulnerability to climate change in Tharparkar District. Factors affecting the frequency and severity of impacts are social, environmental, and economic conditions under which impacts are worsened. These factors inform the development of future strategies and actions to prevent or mitigate impacts. The literature review yielded articles published in science and engineering journals, national and provincial government reports, international and domestic non-governmental organization assessments, briefings from aid organizations, and

news stories. Sources include, but are not limited to, the Thardeep Rural Development Programme (TRDP), Provincial Disaster Management Authority (PDMA), Health and Nutrition Development Society (HANDS-Pakistan), United States Agency for International Development (USAID), and non-governmental organizations like the Sukaar Foundation and the Association for Water, Applied Education and Renewable Energy (AWARE).

Stakeholder engagement and in-person interviews were also a part of the development of the report. Meetings with the Georgetown Institute for Women, Peace, and Security, the Sindhi American Political Action Committee, and the U.S. Department of State informed the scope and design of the report. Interviews with technical, subject-matter experts on topics relevant to the report from the Sindhi Association of North America and Shifa Foundation informed the content.

Analysis of the impacts of climate change on women in Tharparkar District is a useful case study for the lives and conditions of women living in poverty around the world. Policy recommendations are provided towards the end of the report. Capacity-building at the grassroot level, as well as investment in resiliency measures for the agricultural sector are of paramount importance. Recommendations are gender-sensitive, climate compatible strategies in response to the environmental and humanitarian crisis. To provide context, comparative analyses from Bangladesh, Nepal, and Punjab, India are included. These three examples share demographic similarities and face comparable development challenges, which each has chosen to tackle in a unique manner.

This report attempts to identify the causes of women's vulnerability to climate change and examine the linkages between factors that contribute to the degree of vulnerability of women, and how these linkages can be used to formulate gender-sensitive policies to reduce vulnerabilities for women and decrease gender inequality within Tharparkar District.

## IV. FACTORS INFLUENCING WOMEN'S VULNERABILITY

Many factors contribute to the vulnerability of women living in Tharparkar District to climate change: gender inequality, reliance on agriculture and livestock, nutrition, water access, and migration, amongst others. This section investigates the environmental, social, and economic concerns that burden women and the combination of factors that increase women's vulnerability to climate change (See Figure 26, 27, & 28).

### Subsistence Farming & the Agrarian Economy

#### *Agriculture*

The people of Tharparkar District subsist on agriculture, livestock, and day-to-day wages. Agriculture and livestock support 30% to 40% of the population, respectively, while the remainder rely on daily wages from employment in the services sector, local trading, or transportation[132]. Agriculture is dependent on monsoon rainfall. Irrigation is not practiced in Tharparkar District. High yields are only possible with a significant and timely amount of rainfall. Rural communities have adapted by using water stress resistant or water efficient crops, like the marama bean[133]. Tharparkar District has a single crop season[134]. For a good crop, four or five periods of rainfall are needed. Multiple years of drought means repeated crop failure. The result is a significant loss of income and malnutrition. According to the Thardeep Rural Development Programme's assessment of drought in 2014, 28% of families interviewed were able to cultivate their land. The majority, 54%, bought seed on credit. Thirty percent of families purchased seed with cash and only 15% owned seeds already. For the majority of farmers, 86%, their seed was destroyed before the first rainfall in 2014[135].

The absence of rainfall for three seasons triggered a drought emergency in Tharparkar District. According to the Food and Agricultural Organization of the United Nations (FAO) and European Union (EU), 100% of Tharparkar District faces severe water scarcity[136]. In 2018, the situation

[132] Consortium Management Unit, 2014
[133] Creswell & Martin, 1998
[134] Sattar, 2014
[135] TRDP, 2014
[136] SDNA, 2019

deteriorated further. The continued shortage of rainfall during monsoon, 69.5% below average, and no rainfall during the month of August exacerbated existing agricultural and domestic problems. The Pakistan Meteorological Department has predicted no adequate rainfall in the near future either, meaning the situation will worsen with diminishing resources. Food insecurity and malnutrition will escalate as families are forced to sell goods they would otherwise consume themselves. Crop production will plummet, and the death of livestock will increase. Having analyzed the situation, the district administration has appealed to international aid organizations to send teams and support relief efforts for affected peoples[137].

The lack of an ecological safety net and the degradation of land from traditional practices has left Tharparkar District's farmers more vulnerable and its population more exposed to the impacts of climate change. The droughts of 2014 and 2017 to 2018 reveal the importance of rain in the lives of the people, and how unpredictable rain patterns have led to changes in the quality of land and groundwater, stunted crop yields, and worsened livelihoods and well-being. It is important to distinguish between the impacts of climate change and the poor socio-economic conditions or market forces already present in Tharparkar District. Thardeep Rural Development Programme's research suggests that structural changes and access to alternative livelihoods are required to combat the issues faced by Tharparkar District's at-risk communities, rather than emergency rations or wheat provided by the government too late in the year. To address food insecurity, communities must be given more and different livelihood options that increase people's skills or decrease their reliance on rain. Emergency assistance does not address the root causes of the crisis: persistent economic inequalities, unaccountable governance, inequitable distribution of resources, decision-making by the few for the many, and ill-timed public policy[138,139]. Climate change aggravates an already dangerous situation.

[137] ACT Alliance, 2018
[138] TRDP, 2014
[139] Oxfam, 2017

***Livestock***

Livestock also falls victim to droughts. Water shortages make animals weaker and more prone to disease. The consumption of plants mixed with sand can cause digestive problems, metabolism disorders, and infections[140]. As infection spreads, the price of livestock plummets. Farmers are either unable to sell their livestock or accept prices that cannot support their families' needs. Without veterinary intervention, illness is often fatal. Without access to milk or meat, the population becomes more vulnerable to malnutrition. Their resilience to changes in weather or other climate change-related disasters is also reduced.

In Tharparkar District, almost every household keeps livestock. On average, a household has eight animals. This number is reduced when large livestock are moved to barrage areas during times of drought. Between August and October 2018, at least 6 goats or sheep and 5 cows died in every village[141]. The provincial government set up 235 relief camps for livestock and administered preventative vaccines to nearly 3 million animals. An additional 40,000 sick animals were treated free of charge.

In 2014, a sheep pox outbreak occurred in Tharparkar District. Herds were culled. The sheep pox resulted in at least 42,000 deaths[142]. The livestock mortality rate due to drought and disease reached 70%[143]. More than 300,000 animals died in total. Causes ranged from sheep pox or other diseases to the lack of fodder or water. During the three-month span from July to September 2014, 14% of all sheep and 4% of all cows or large domestic animals died[144]. In total, farmers lost approximately one-third of their cows and camels, and two-thirds of their small ruminants like sheep or goats[145]. Between 2014 and 2016, farmers lost 48% of their livestock[146]. The death toll was so high because diseases went untreated. Farmers and their

[140] Khangharani, 2014
[141] FRDP, 2018
[142] Di Nunzio, 2014
[143] HANDS Pakistan, 2014
[144] TRDP, 2014
[145] Consortium Management Unit, 2014
[146] UNICEF, 2016

families did not have the readily-available cash to pay for veterinary care or vaccines. In addition, medicine or vaccines for animals were limited. Instead, farmers sought to sell their remaining livestock. The sale of livestock is usually a last resort to cope with lack of resources and famine. At that time, so many animals flooded the market, and the herds were in such poor condition, the price of livestock bottomed out[147]. Current conditions in Tharparkar District make another mass die-off inevitable.

***Trends in Agriculture & Livestock***

The discovery of coal in Tharparkar District and changing agricultural practices threaten the rangelands, and locals' rights to livelihood and food security. More than 92% of the land cover of Tharparkar District represents the livelihood and food source of the population[148]. Livelihoods dependent upon grazing animals and subsistence on agriculture are endangered by erratic and variable monsoon rains and rising temperatures.

Tharparkar District has an estimated 109,516 hectares of rangeland. Rangeland is not allotted for the purpose of cultivation and is not privately owned. When there is no cultivated crop on farmlands, they are used interchangeably with rangeland as open meadows for livestock. It is customary to allow neighbors and other community members to graze their animals on farmland when not under crop. These customs and laws stem from the traditions of pastoral communities who used to roam the arid lands. In the past, to maintain livestock during periods of drought, communities would migrate without restrictions. Cultivated, irrigated areas along the herders' route sustained the livestock and, in turn, the agricultural lands benefited from the manure and weeding. When not migrating, pastoral communities would harvest and thresh the wheat crop, which required extra manual labor. Today, cooperative relationships are no longer possible. Fertilizer, modern horticulture, mechanization, and commercial livestock farming challenge pastoralists in the region[149].

[147] Consortium Management Unit, 2014
[148] Land Cover Atlast of Pakistan, 2014
[149] Herani, 2007

The discovery of coal in the Thar Desert also impedes the free movement of peoples across the district. Thar is the 16th largest coal reserve in the world, although it is low-grade lignite. Land and resource loss, and changing and fragmentation of rangelands, negatively impact those dependent upon them. A lack of recognition of land and resource-ownership rights, poor land-use planning, and privatization hurts rangeland users, pastoralists, and hunter-gatherers, all of whom are better suited to adapt to climate change. Pastoralism, and livelihoods like it, are able to adapt to, and have a history of coping with aridity and unpredictable climatic events and stress, that does not exist amongst stationary farmers[150,151].

For farmers determined to keep their land under crops, trends in productivity, nutritional value, and market price are discouraging. When comparing the 2017-18 agricultural season with the 2016-17 season, overall crop production for wheat was reduced by 23%; sorghum by 33%; rice by 35%; cotton by 18%; cluster beans, millet, and sesame each by 83%; and pulses/lentils by 95%. In Tharparkar District, cluster bean production decreased by 92%, millet by 84%, pulses/lentils by 95%, and sesame by 100%. Production of all crops decreased in arid areas from the 2016-17 season. A greater reduction in the production of cotton, millet, pulses, sesame, and chillies was reported for women-headed households. Overall, cereal production was only sufficient for household consumption for about 2.3 months. Production of pulses/lentils for personal consumption was only sufficient for 1.9 months. The area cultivated, as compared to the 2016-17 season, decreased as well. The cultivation area in Tharparkar District for wheat was reduced by 100% and for millet by 49%[152] .

Markets play an important role in household income and food security. Communities and rural villages are highly dependent on markets for selling and sourcing their goods, agro-livestock commodities, labor, and other non-food items. In Tharparkar District, 21.6% of households have to travel less than 10 kilometers to reach the nearest market, 24.6% have to travel between 10

[150] Herani, 2013
[151] Jamali, 2018
[152] SDNA, 2019

and 20 kilometers, and 53.8% of households travel over 20 kilometers to reach the nearest market[153].

At local markets, prices are controlled both regionally and nationally. Middlemen travel to markets in Tharparkar District for goods that they then mark-up and re-sell outside the district. The goat market in Mithi is always busy. In 2016, a Pre-Crisis Market Analysis (PCMA) was conducted under normal or emergency drought conditions. The price of wheat flour and the strength of the goat market were determined to be the best indicators of stability in Tharparkar District[154]. National and global commodity prices also impact the value of goods and agricultural products in Tharparkar District. The national government committed to buying wheat and wheat flour at a fixed cost from farmers. The global price of wheat, in November 2018, was around $234 per ton. In Pakistan, the government paid farmers Rs 1,300 per every 40 kilograms during the harvest in May and June of 2018[155]. This is approximately $300 per ton. To stabilize the price of wheat, the government imposed import tariffs and incurred costs to buy, store, and dispose of excess wheat. In Pakistan, wheat production has increased beyond domestic demand. Subsidies are provided to exporters. Prices for wheat and other food items are kept artificially high and alleged to reduce poverty in rural areas; however, this is not true. The bulk of Pakistan's poor populations in rural areas are small-scale farmers and landless laborers. They are net buyers of food. High prices for wheat and other agricultural products favor large farms with surplus to sell, not poor farmers who cannot afford to feed their families.

**Nutrition**

Cereal, fats, sugars, and dairy products are dietary staples in Tharparkar District. Crops, like wheat, account for more than 50% of caloric intake[156]. Households have little dietary diversity and consume less micro-nutrient rich foods like vegetables and fruit. Calcium, iron, and vitamin

[153] SDNA, 2019
[154] PCMA, 2017
[155] Raza & Khan, 2018
[156] Pakistan Food Security Cluster, 2017

A deficiencies are common in desert and rural communities, because of the cost of oil, eggs, vegetables, and fruit.

Tharparkar District's drought had a debilitating impact on food security and malnutrition, disproportionately affecting women and children. Many media reports indicate that provincial and national attention was only brought to bear on the 2014 drought after 120 children died. Ultimately, over 400 children died as a result of the drought[157]. According to an assessment by the Thardeep Rural Development Programme, 82% of the surveyed population were found to suffer food insecurity, with food stores for a maximum of 15 days. Seventeen percent were food secure for up to six months and only 1% were food secure for a full year.

Food insecurity is exacerbated by indebtedness, either to neighbors, those of higher status, or families with greater access to resources[158]. Debt and indebtedness impact an individual or community's ability to manage drought or other difficult situations. Indebtedness amongst respondents in Thardeep Rural Development Programme's study was reported at 69%. In 2013, 70% to 80% of families surveyed were in debt for seeds, cropping, vaccines for livestock, or land preparation pre-monsoon. In 2014, at the start of the drought, similar numbers were reported pre-monsoon[159]. After two seasons without rainfall, families who had accrued debt were unable to repay loans or settlements.

This situation is made worse when the debt is owed to another person or family of higher social status. Often, families with greater resources will give food or loans to others of lower standing in exchange for a portion of any future harvest[160]. When drought causes crop failure, families are forced to go without food or forgo medical expenses in order to repay the loan. This affects their food security and health in the long-term. This cycle repeats as families most vulnerable to

[157] Khangharani, 2014
[158] TRDP, 2014
[159] TRDP, 2014
[160] Consortium Management Unit, 2014

drought and starvation become increasingly desperate as their income from livestock, harvests, or other agricultural sources suffer.

Below-average rainfall during the 2016 monsoon season resulted in no or substantially less agricultural production and significant livestock losses for the third consecutive year[161]. Response has been limited. As of February 2017, a large percentage of the population remained moderately to acutely food insecure. Global Acute Malnutrition (GAM) and Severe Acute Malnutrition (SAM) rates were well above emergency levels. The region remains on the verge of a humanitarian crisis[162].

**Water Access**

Access to water is a key problem for Tharparkar District. With a population of over 1.6 million and roughly 5 million heads of livestock in the district, and annual rainfall as low as 9 millimeters, drought is common. Less than 5% of the population has access to a supply of freshwater. Even the district capital, Mithi, only receives freshwater twice a month[163]. The cost of laying down water supply lines is prohibitively expensive. Instead, the population relies on wells. Dug wells present their own problems and are unreliable sources of drinking water. First, they are recharged by rainfall, which often does not arrive. In addition, when precipitation does occur it can be an extreme event that causes runoff but does not percolate to recharge local aquifers. Second, fluoride contamination of groundwater resources has led to serious health problems.

Women are tasked with the collection of water, often making several trips to meet the family's cooking, washing, or drinking demands. Reverse osmosis plants or diesel-operated tube wells installed by the government are often too expensive for communities to operate. Solutions like solar-powered turbines, which pull water out of the wells and store it before pumping it into homes, are a viable alternative. In 2010, the Association for Water, Applied Education, and

[161] FAO, 2019
[162] WFP, 2018
[163] NDMA, 2018

Renewable Energy (AWARE) introduced metered solar pumps into villages in Tharparkar District. Each household pays for the amount of water used[164].

Indigenous water-purification technologies should be considered as well. One such technique is called “mussafa”. It involves adding graded sand as a filter to clay pots used to store water. The Thardeep Rural Development Programme (TRDP) is also experimenting with solar disinfection to kill bacteria and reduce waterborne illness. TRDP has already built rainwater collection tanks serving nearly 16,000 households in marginalized communities, which require minimal operating or maintenance costs[165].

In 2015, the desalination complex in Mithi was opened. It is the largest solar desalination plant in Asia. The complex is designed to provide 8 million liters of drinking water per day and to produce one megawatt of electricity. These benefits are distributed amongst the residents of Mithi and 100 other nearby villages. In total, the Government of Sindh and Pak Oasis, the company that owns the desalination complex, built more than 700 water treatment plants[166]. In 2017, Pak Oasis announced the closure of 84 reverse osmosis plants that operated in Tharparkar District. These 84 plants went offline after the Sindh Coal Authority failed to renew its contract with Pak Oasis. Pak Oasis could no longer afford to run the plants and pay staff salaries[167]. This incident highlights the loss when waterworks investment is squandered or ignored, and the importance of water solutions for the future of Tharparkar District.

When piped water is available, girls are able to attend school and women have more time to devote to other activities, like employment outside the home or running their own small business. Access to freshwater decreases the rates of illness and waterborne disease as well. The larger social impact is important too. It is a source of income and dignity. Women are not

[164] AWARE, 2019
[165] LEAD, 2017
[166] Ebrahim, 2015
[167] Samoon, 2017

forced to collect water from the well or tap of the local landlord. This is a form of empowerment and reduces the feudal hold on the community.

**Migration**

During the 1980s and 1990s, the population of Sindh Province accounted for 23% of the entire country. The region experienced roughly 10% of the country's internal migration[168]. In comparison, Punjab Province in Pakistan experienced more than 50% of the country's internal migration during those decades[169]. Data on migration from the 2017 census collection is not yet available for comparison.

Internal migration occurs in unindustrialized areas with environmental pressure on land and other natural resources. Usually, individuals or families move from rural to urban areas within the same province. At most, they travel to other urban areas within the country in pursuit of opportunity. Due to Pakistan's population's historical lack of mobility, tied to the land and hampered by poverty, social structures linking rural communities to urban networks never developed. Rural to urban migration was less likely without these connections. Over the last decade, drought has forced this pattern to change[170].

The sale of livestock and migration are indicators of drought; they are the last option when no alternatives remain. In 2014, approximately 175,000 families fled Tharparkar District[171,172]. Temporary or seasonal migration is to be expected in Tharparkar District. During dry winter months or past years of drought, families migrate elsewhere within Sindh to harvest sugar, wheat, or rice, and to pasture their livestock. Seasonal migration occurs in April or May when wheat is harvested and is practiced by between 15% and 20% of families[173]. That number

[168] Pakistan Population & Housing Census, 1998
[169] Sattar, 2014
[170] Sattar, 2014
[171] Shaik & Tunio, 2014
[172] PDMA, 2014
[173] Sattar, 2014

increases to between 35% and 45% of families during drought[174,175]. In 2014, an additional 25% of families chose to migrate, both with or without their livestock[176]. Data on reasons for migration from the 2017 census is not yet available for comparison.

Families with livestock are more likely to migrate in search of food and water for their animals. Landowners are less likely to migrate for fear of losing their property[177,178]. Some families cannot migrate for socio-economic reasons. It can be prohibitively expensive to leave home in search of better economic opportunities in urban areas or to find irrigated areas to cultivate. And, seasonal labor does not pay well. Traveling long distances with livestock puts them at risk, either from lack of water or their already weak condition. In 2014, 19% of livestock was moved to better-irrigated areas. Twelve percent died and 4% was sold[179].

Permanent migration is often impossible as well. Poverty-stricken families do not have the funds to relocate[180]. Instead, a single member of the family will move to a more urbanized area in search of alternate sources of income. According to a survey carried out by the Thardeep Rural Development Programme, 73% of migration for livestock grazing or in search of agricultural labor was undertaken by a single family member. This is called partial migration. In only 27% of cases did the whole family move[181].

There are more than 25 different ethnic and religious communities in Tharparkar District. Muslims comprise 64%. Hindus make up the remaining 36% of the population[182]. The largest tribes are Bheel, Kolhi, and Meghwar[183]. These communities are the most affected by drought. They traditionally migrate every year during the harvest season, in April or May. In 2014, due to

[174] Khangharani, 2014
[175] Care and Relief Foundation, 2015
[176] Rustogi & Amir, 2018
[177] Kolhi, 2014
[178] Herani 2008
[179] TRDP, 2014
[180] Rahma Islamic Relief, 2015
[181] TRDP, 2014
[182] Pakistan Bureau of Statistics, 2018
[183] HANDS Pakistan, 2014

the drought, these communities moved en masse in August and September, which is highly unusual[184]. Sixty-four percent of migrants who moved their entire families in 2014 were Bheel and Kolhi. Only 6% of migrants were Meghwar.

The first wave of migration often impacts nearby districts, in this case Sanghar, Badin, Umerkot, or Mirpurkhas. People move in search of work, food, and shelter. Those who choose to migrate later or further usually have more resources. These families send a single member of the household, usually the head of the household, to find better-irrigated areas or labor opportunities. This individual will send their earnings back to support the rest of the family in Tharparkar District. The majority of those who partially migrate are Meghwar, roughly 25%. Bheel and Kolhi individuals make up 21% and 11% of all partial migration, respectively. The remaining 42% are from the other 22, mainly Muslim, communities[185]. Muslim migrants tend to move to urban centers, Karachi or Hyderabad. They keep their homes in Tharparkar District and send money back to their families. This prevailing trend of partial migration amongst Muslims in Tharparkar District indicates a strong connection to the land and local communities; social and religious ties that bind them to their homes even as environmental conditions deteriorate.

In 2019, Oxfam and the International Union for the Conservation of Nature (IUCN) organized a conference on climate change in Sindh Province. The conversation covered the extent of government efforts to manage climate change and identified gaps in current policy and infrastructure. At the event, Oxfam launched its report and screened a short documentary on climate-induced migration in Pakistan. The report suggests Pakistan's provincial and national governments adopt a climate change financing framework to mitigate and adapt to climate change. Oxfam's assessment links rising sea level and land degradation to food, income, and residential insecurity and to climate-induced migration[186]. The report also stressed the importance of gender-sensitive responses, such as improving access to healthcare, safeguarding

[184] Consortium Management Unit, 2014
[185] Consortium Management Unit, 2014
[186] IUCN, 2019

food security, and raising awareness, because women constitute 48.9% of the migrating populace[187].

**Gender Inequality**

Gender equality assures decent employment opportunities for both women and men. The improvement of livelihoods is a crucial element for affecting social and institutional change that leads to sustainable development[188]. Climate change offers an opportunity to re-examine gender norms and transform gender relations in the emerging, volatile climate change and post-disaster future[189].

Gender is recognized as a significant indicator of vulnerability during and after climate change-related disaster events[190]. A woman's already tenuous place in society is compounded by the loss of control of natural resources necessary for everyday life: water, means of production, information, poverty, and exposure to unsafe conditions. Women are more likely to be living in poverty, this is true the world over. They have no ownership of land or the financial resources to protect themselves after a disaster[191].

On the World Economic Forum's Gender Inequality Index, Pakistan ranked 127th from 1990 to 2010, behind its neighbors Nepal in 98th and Bangladesh in 117th [192]. On the 2014 Gender Gap Index, Pakistan ranked 141st out of 142 countries. This low position was due to severe inequalities in access to healthcare, education, and employment[193]. In 2017, Pakistan was ranked 143rd out of 144 countries, last but for Yemen[194]. In 2018, Pakistan was again second to last, this time out of 149 countries[195].

[187] International Organization for Migration, 2015
[188] ILO, 2017
[189] Alston, 2014
[190] Dankelman, 2010
[191] Alston, 2014
[192] WEF, 2011
[193] WEF, 2014
[194] WEF, 2017
[195] WEF, 2018b

From July 2017 to April 2018, a reported 1,643 cases of violence against women occurred in Sindh Province[196]. In Tharparkar District, there is a dangerous underreporting of domestic and sexual abuse, particularly in the Muslim community. The open sale of girls and women in markets has been reported in several underdeveloped parts of the country, including the Thar Desert. Women are sold by their husbands, families, or other agents. Some women, both trafficked and local, are killed if they refuse to cooperate or earn money through prostitution. Journalists reporting on the trafficking of women have been threatened or worse. Sufi Mohammad Khan was killed in 2001 after reporting on a drug and human trafficking ring in Tharparkar District, which he claimed was being orchestrated by a local, feudal family and allowed by the government[197].

Some women in Tharparkar District have rebelled against oppressive traditions and assumed positions as community leaders. After multiple civil society organizations led by women reported no action had been taken by the Ministry of Climate Change on its climate change policy in 2012, district representatives were dispatched to raise awareness[198]. Non-profit organizations working in rural communities have reported high rates of community participation and receptivity to service provision and delivery models that incorporate locals[199]. Agricultural research institutions have made great advances amongst the Tharparkar District agricultural community by organizing and educating farmers at the grassroots level[200]. These women-led initiatives prove that any development interventions must be technically efficient and contribute to the broader goals of survival, security, and human dignity.

Empowering girls and women with education provides them with opportunity outside the home. In Tharparkar District, women have sought employment as truck drivers for the Sindh Engro Coal Mining Company (SECMC). As of 2017, thirty women had been trained to drive 60-

[196] Mansoor, 2018
[197] Amnesty International, 2002
[198] UN Women, 2018
[199] Dawn, 2015
[200] IUCN, 2007

ton dump trucks. The SECMC, a Pakistani-owned business, has been mining the low-grade coal under the Thar Desert. Until recently, energy experts were unsure if the region's abundant, but poor quality coal could be an economic resource. Views began to change after significant investment in the China-Pakistan Economic Corridor (CPEC). With the increase in business, truck drivers earn up to Rs 40,000 ($380) per month[201]. Women aspiring to such jobs are overcoming significant cultural barriers in society. Some even attend medical school in hopes of a better future. Between 2005 and 2010, 5,036 female students were enrolled in medical school; however, only 2,518 became practicing physicians. The Peoples University of Medical & Health Sciences for Women was established in 2012 in Shaheed Benazirabad District, Sindh to provide a safe academic atmosphere for female students and to destigmatize women working in medicine[202]. The University was instrumental in transferring seven female medical officers to Tharparkar District in 2018 at the request of Senator Krishna Kumari Kohli, the first Hindu Dalit woman elected to the Senate[203].

The provincial government of Sindh releases yearly analyses of their Gender Reform Action Plans (GRAPSs). In 2004 and 2005, GRAPs included suggestions for women's employment in the public sector, policy and fiscal reforms, capacity-building and development interventions, political participation, institutional restructuring, gender mainstreaming, and pro-environment actions[204]. These suggestions have since been approved by the provincial government. The Ministry of Women Development established 26 points of comparison between comparable agencies to coordinate planning on gender inequality issues. These correspond with 26 government positions, only 7 of which were held by women[205]. With the 18th Amendment, the Ministry of Women Development was eliminated and full responsibility for women's development issues was devolved to provincial governments[206]. In the executive and legislative branches of government, a percentage of seats are reserved for women. Not so in the Sharia or

[201] Hassan, 2017
[202] Sherazee, 2012
[203] Aftab, 2018
[204] Shah et al., 2015
[205] ADB, 2000
[206] ADB, 2016

Supreme Court. None of Pakistan's Supreme Court judges are women and, as of 2016, only 5% of the high courts' judges were women[207]. Women, even when they are elected to office or have representative seats reserved for them, are often untrained in gender analytics. They lack the skills necessary to assess policies or programs for gendered perspectives. They also have little to no power to influence decision-making in favor of women.

Despite organizations and ministries, at the national and provincial level, whose stated missions are women's empowerment, the government has been unable to offer women more opportunity. Lack of political will and institutional capacity, coupled with non-existent to weak coordination efforts, have left women without advocates across sectors and planning levels. Agencies have failed to foster vertical and horizontal connections with each other to hold other departments or ministries accountable for formulating and including women's interests in their planning. For example, the Ministry of Women Development did not have the technical or intellectual capacity to assist other agencies with their efforts to mainstream gender. The Ministry did not produce a national policy focused on women's issues[208]. National and provincial governments struggle to delegate responsibilities, which has led to confusion and inefficient coordination. And, current climate change policy, which does include gender and disaster preparedness, focuses on coastal areas. There is also a shocking lack of implementation across rural Sindh[209]. This attributable to several factors mentioned already: lack of political will, control of resources by the elite, and coordination failure. The implementation of climate and gender-related policies in rural areas at the district level is clearly stymied. Even if policies are enacted, they still may not significantly improve the lives of women living in rural Tharparkar District or reduce their vulnerability to the impacts of climate change.

**Women's Health**

There are alarmingly high rates of malnutrition and disease amongst women and children in drought-affected areas. Ninety percent of Thari women are underweight. The mean weight was

[207] Imran, 2016
[208] Government of Pakistan, 2016
[209] Noshirwani, 2012

just 44.2kg[210]. Almost 93% of households do not have the purchasing power to buy food. Instead, they rely mostly on seasonal harvests and the sale of livestock[211]. Around 30% of women and children travel over an hour for water. As the quantity and quality of food and water available to families is reduced by extreme weather events or drought, women's share of food nutrition falls disproportionately.

UNICEF's Community Management of Acute Malnutrition program has been working in cooperation with the Government of Sindh[212]. The international presence in the region was strengthened in 2014 after the deaths of over 100 children were reported in Tharparkar District[213]. UNICEF's partner organizations, Shifa Foundation and the Health and Nutrition Development Society, are carrying out emergency nutrition initiatives across the district. Activities include:

- Surveying children and pregnant or breastfeeding women for their nutritional status;
- Delivering micro-nutrient supplements;
- Instruction on health and nutrition;
- Teaching best breastfeeding practices and feeding older infants;
- Treatment of Severe Acute Malnutrition (SAM) and Moderate Acute Malnutrition (MAM) cases;
- Providing supplementary or therapeutic food for sick children;
- Referring medically complicated cases to stabilization centers;
- Arranging transport to hospitals.

Serving communities in hard to access areas is essential for timely detection of malnutrition and raising awareness about its consequences. Female health workers and support groups for mothers have an important role to play in identifying malnourished children and women. These

[210] HANDS Pakistan, 2014
[211] Government of Sindh, 2011
[212] UNICEF, 2015
[213] Reliefweb, 2019

individuals and societies are trained to refer women and their families to designated Community Management of Acute Malnutrition centers. These groups also help new or teenage mothers better understand infant and young child feeding practices[214].

Between 2011 and 2016, more than 1,500 children under the age of five died in Tharparkar District hospitals[215]. This figure is based on a survey of five government hospitals, including the Civil Hospital in Mithi which serves 1.5 million people. There is no official record of infant mortality or deaths among young children outside these five hospitals. Lack of food and clean water, malnutrition amongst women, child marriages, the absence of family planning, and government neglect, have left otherwise healthy children and those with pre-existing conditions in danger. Untrained midwives and unhygienic delivery conditions threaten the lives of children from birth. Almost 80% of children born in Tharparkar District are underweight[216]. Complications at birth and up to the age of five months are lethal. Nearly 47% of infants in Tharparkar District are considered acutely malnourished by the World Food Programme[217]. The infant mortality rate is 87 per 1000 live births, compared to the national average of 69 per 1000.

Common infections go untreated. There are six trained pediatricians to treat the more than half-million children in Tharparkar District[218]. There are five gynecologists for female patients[219]. Even at the largest hospital in the district, there is inadequate space to accommodate the patients at the best of times. During drought or times of widespread illness, wards overflow. Families and patients must sleep on the floor in the courtyards. Between 300 and 400 children are admitted to the Civil Hospital in Mithi each month. Between 15% and 20% of those children die, according to doctors who serve the community[220].

[214] Aguayo, 2018
[215] Ghani, 2016
[216] Ahsan, 2017
[217] WFP, 2015
[218] Sand, 2018
[219] Ali et al., 2018
[220] Ghani, 2016

Hospital staff are underpaid and overworked. There is a lack of female medical staff or those trained specifically in women's health issues. Across the district, there is an alarming lack of medical staff[221]. Dispensaries and pharmacies are understaffed. When staff do show up for work, they often go unpaid. When doctors try to reach isolated communities, they are foiled by the shortage of mobile medical units or mobile units unauthorized or unable to travel off-road to rural villages. Inadequate facilities and lack of staff or specialists force doctors to refer patients outside the district, to Hyderabad or Karachi. A journey of over 400 kilometers is impossible for some. Paying for travel and accommodations in the city places a huge financial burden on poor families. Often, if the sick child is male, parents will try to raise funds or borrow money to take him to another hospital. Girl children are left in local hospitals or returned to their villages untreated.

The need for girl's education, the abolition of early marriages, improvements in vaccination rates, raising awareness about nutrition, access to clean water, and the implementation of family planning are all needed across Tharparkar District.

**Violence Against Women**

Laws protecting women from violence at the hands of family members or other men in their community are weak. Women in Tharparkar District face endemic domestic violence, sexual harassment, and the threat of "honor killing", especially in rural, culturally conservative, agricultural regions. The 18th Amendment to Pakistan's constitution led to the passage of many provincial laws meant to protect women. These favorable laws are rarely enforced in rural areas.

Young girls in Tharparkar District are often taken out of school at an early age and forced to marry by twelve years old. Their lack of education leads to less economic opportunity and makes them more vulnerable to abuse. 87% of women in the region have experienced domestic

[221] Rana, 2014

violence[222]. Shelters for victims exist, but there is no financial support for victims wishing to leave their homes or communities which makes it difficult for them to escape their abusers permanently. Sexual harassment is also widespread at educational institutions where male professors and students of all ages attempt to force women out of their studies. Some families elect to never send their girls to school for fear of sexual assault. Even women who do attend school through university are encouraged to stay at home after marriage.

So-called "honor killing" also occurs. Prosecution of such cases is difficult because of the power of local Jirga councils. Jirga councils are comprised of male elders within a community or tribe. Often, they pressure the victim's family to accept cash payment as settlement for the crime[223]. The power of these councils to propose such payments, and the force they exert over families to accept them, is illegal. Jirga decisions still hold sway with many communities at the expense of the rights of the woman involved. Much of the progressive legislation passed at the provincial level after the enactment of the 18th Amendment is considered "window dressing" to appease western countries.

Violence against religious minorities is common in Pakistan; however, in Tharparkar District, Hindu and Muslim populations have long lived in relative harmony. Recent acts of violence against women and minorities have brought attention to the influx of people from other regions. Locals have reported more activity by organizations that promote a less tolerant Islam and sometimes operate as façades for illegal groups, especially in the desert town of Mithi. Al Khidmat, a branch of the Jamaat-e-Islami socially conservative political party, recently built several mosques and hospitals in the area. Associates of Jamaat-ud-Dawa, a branch of the militant group accused of the 2008 Mumbai attacks, and Lashkar-e-Jhangvi, a Sunni militant group, have also moved into Tharparkar District. The spread of religious extremism has instilled fear in formerly peaceful communities[224].

[222] US Department of State, 2007
[223] Human Rights Watch, 2017
[224] Zahra-Malik, 2018

## V. IMPLICATIONS FOR PAKISTAN'S CLIMATE GOALS

The impacts of climate change on water access and the lives of women in rural Tharparkar District can be used as a representative case study for the vulnerability of women living in poverty to climate change all over the world. Studying these communities, their routines, struggles, and small triumphs, paints a clear picture of a nation's development priorities and challenges. Even as developing nations industrialize and urbanize, providing citizens with better services and resources for their health, education, and prosperity, they are stymied by the neglect and marginalization of their poorest residents.

Tharparkar District is one of the poorest districts in Pakistan: 84.7% of the population live in poverty[225]. This means more the 1.4 million people, of the 1,649,661 people counted in Pakistan's 2017 census, live in poverty in Tharparkar District alone[226]. The majority are women. According to the 1998 census, the sex ratio stood at 83 females to 100 males[227]. Today, the population stands at 767,266 women and 882,365 men, a ratio of 87 women to every 100 men[228].

Over the last decade, natural disasters, economic disruption, and food insecurity have led to high levels of deprivation and a steady increase in indicators of multi-dimensional poverty in the district. It has been proven that climate hazards affect the poor and already vulnerable groups disproportionately by increasing exposure and susceptibility and decreasing their ability to cope or recover from damages[229]. This results in a greater loss of life, human capital, assets, and income. Without taking significant steps to address poverty and the threat posed by climate change in Tharparkar District, the district will hold back Pakistan's achievement of its sustainable development goals.

[225] ACAPS, 2017
[226] Pakistan Bureau of Statistics, 2017
[227] Rajar et al., 2007
[228] Pakistan Bureau of Statistics, 2017
[229] World Economic and Social Survey, 2016

In 2016, as part of Pakistan's national Sustainable Development Goals (SDGs) initiative, the Government of Sindh signed the global Agenda 2030 and committed to the 17 SDGs laid out therein. These SDGs provide direction for human and economic development; a focus on human prosperity, poverty reduction, climate stability, and a healthy environment. To that end, the Government of Sindh and the United Nations Development Programme (UNDP) have signed a public-private partnership agreement with the Thar Foundation to raise the socio-economic status of Tharparkar District's population[230]. This effort targets Pakistan's youth under 30 (who comprise 64% of the population), minorities, and women. This commitment to several high priority SDGs is intended to help marginalized segments of Tharparkar District's population develop necessary skills and provide employment opportunities.

At the national level, Prime Minister Imran Khan's government has made a vocal commitment to a "green political will"[231]. At COP24, in Katowice, Poland, Pakistan was the first developing national to commit to review its Nationally Determined Contribution (NDC) before the Paris Agreement takes effect in 2020. This will include the expansion of the Billion Tree Tsunami Afforestation Project into the 10 Billion Tree Tsunami. The government also intends to capitalize on Pakistan's latent potential for wind, solar, and hydropower energy. These commitments are an improvement over the NDC originally submitted under the Paris Agreement, which projected a four-fold increase in emissions by 2030 due to investments in coal and natural gas. Although some of the coal-fired power plants proposed under Khan's predecessor have already been built and are now operational, Khan's government is committed to strict monitoring of their emissions. In addition, the new government is working to revoke arbitrary caps placed on the amount of renewable energy generated and fed into the grid in each province. This policy is a legacy of the former government's commitment to fossil fuels. As of December 2018, renewable energy is the cheapest form of electricity generation in Pakistan[232].

[230] UNDP Pakistan, 2018
[231] World Economic Forum, 2018a
[232] Nicholas & Buckley, 2018

Pakistan‘s engagement at COP24 was lauded by the international community. Although only a small delegation was present, they effectively advocated for the country’s vulnerability to climate change and actively participated in negotiations. Pakistan was elected Vice President and Rapporteur of the Conference of the Parties to the UNFCCC. It will be instrumental in organizing the talks in 2019. Pakistan also joined five other technical bodies at the COP to regulate climate action, commercial flow, and Green Climate Fund financing[233].

While these commitments are honorable, without the integration and consideration of women living in poverty in rural communities, in Tharparkar District or elsewhere, Pakistan’s ambitious goals will be unachievable. If Karachi employs a fleet of biogas-powered buses, millions of women living in remote, isolated communities will still have to walk hours on dirt roads to local markets. Even if Pakistan builds climate resilient dams to improve water management, women in Tharparkar District will still suffer during periods of drought. And, when Pakistan transitions to renewable energy, millions of women will still lack access to electricity.

[233] The Express Tribune, 2019

## VI. CASE STUDIES

Lessons learned and success stories from the following case studies informed the policy recommendations proposed in the report. The countries of Bangladesh and Nepal, as well as the state of Punjab in India, are appropriate case studies to consider for four important reasons. First, their geographic similarities to Tharparkar District. Second, the shared experience of water scarcity due to climate change and climate change-related disasters. Third, their Muslim and Hindu populations. And, finally, the marginalization of women in rural communities. These four factors make Bangladesh, Nepal, and Punjab, India useful for comparing and contrasting responses to the challenges posed by climate change and crafting successful policy recommendations to address women's vulnerability to climate change in Tharparkar District, Sindh Province, Pakistan.

### Bangladesh

Bangladesh is the 8th most densely populated country in the world, with 168 million people living in 147,570 square kilometers[234]. Bangladesh ranked 136th out of 189 countries in the 2017 Human Development Index and 47th out of 144 countries in the Gender Gap Index from the same year[235,236]. Pakistan ranked 150th on the former and second-to-last on the latter. Bangladesh is located in the delta of the Ganga, Brahmaputra, and Meghna Rivers and experiences high climate variability. The country is already experiencing severe weather events associated with climate change: flooding, drought, erosion, reduced freshwater availability, and the increased intensity of storms like cyclones or monsoon[237].

Bangladesh's population is primarily employed in agriculture; 63% is in either the agricultural, fisheries, or forestry sectors[238]. In 2018, 59.2% of women were employed in agriculture[239]. The impacts associated with climate change disproportionately affect portions of Bangladesh's

[234] CIA World Factbook, 2018
[235] HDR, 2019
[236] WEF, 2017
[237] Climate Change Impact Center, 2009
[238] Kartiki, 2011
[239] World Bank, 2018

population already economically or physically disadvantaged. An individual's health, wealth, race, age, ethnicity, knowledge, skills, and physical ability, in combination with society's power dynamics and gender roles, shape differential vulnerability and determine that individual's ability to adapt to climate change-related weather events. During natural disasters, women and children are at greater risk than men due to gender and socioeconomic inequalities. Women and children are, therefore, more vulnerable to the effects of climate change[240].

Over the last 50 years, Bangladesh has suffered more than 20 periods of drought. This recurrent phenomenon plagues the northwest region, which is already prone to high rainfall variability[241]. In Bangladesh, more than half the population are women, and 80% of women live in rural areas[242]. Women living in rural communities in Bangladesh grow and harvest crops, rear poultry, and process food for distribution. Women in low-income households may also seek employment on construction sites or in the field[243].

Vulnerability to climate change is strongly correlated to rates of poverty within a country. Over 95% of female-led households in Bangladesh live below the poverty line[244]. Female-headed households make up 20% to 30% of all households. These women are not only remarkably poor, but especially vulnerable to climate change[245]. Vulnerability can be characterized as a potent combination of poverty and gender relations. Women are socially and economically disadvantaged. This is perhaps best exemplified at meal times. Male family members and children are fed before wives, mothers, or girls. Whatever is left is distributed amongst female family members. Women's poor nutritional status is a key factor in their inability to cope with risk, in this case the impacts of climate change. Incidents of starvation and malnutrition amongst women in Bangladesh have decreased significantly in the last decade. At the same

[240] UN Women, 2015
[241] CIA World Factbook, 2018
[242] Parvin et al., 2013
[243] Parvin et al., 2013
[244] ADB, 2011
[245] Dankleman, 2008

time, the economy of Bangladesh is growing at a rate of 7.3%[246]. The country's recent provision of social services to its citizens is widely considered a success story.

Coastal communities in Bangladesh are more vulnerable than inland communities. Major threats include cyclones, drought, saltwater intrusion, and the deterioration of the ecosystem. Human-induced environmental degradation is exacerbated by climate change. Flooding or drought increase a woman's daily responsibilities and burden. Women earn less and have a harder time restoring their livelihood after a flood[247]. Societal attitudes restricting the interactions between women and men further limit a woman's ability to move within society or to find new economic opportunity. Their responsibility to care for children or elderly family members further limits their mobility. Female-led households with home-based livelihoods lose twice as much when their homes and land are destroyed. Damaged infrastructure and communication systems impedes their access to markets and aid post-disaster. Often, women are forced to trade within their own villages and accept lower prices[248].

Bangladesh's proposed National Disaster Management Plan for 2008-2015 focused on gendered influences of vulnerability[249]. Specifically, susceptibility to hazard: the possibility of suffering damage and recovery capacity as affected by gender patterns of resource access and control. However, lack of awareness or understanding of climate change and the associated risks have hindered decision-making surrounding adaptation and mitigation in Bangladesh. Instead, women living in poor, rural communities have adopted unique coping mechanisms, which can be characterized in three general camps: avoidance or prevention, management, and recovery strategies.

Avoidance or prevention strategies attempt to predict and prepare for natural disasters based on years of community-held knowledge of the local climate and weather patterns. Homes and

[246] World Bank, 2017
[247] Baden et al., 1994
[248] Cannon, 2002
[249] Government of the People's Republic of Bangladesh, 2008

farm buildings are protected by reinforced roofs and walls. Essential items, like fuel, wood, and fodder, are stored against such disasters. Women are aware of the need to hold some essentials in reserve and are able to collect extra as part of their daily routine. Children are educated about life-saving skills, such as swimming, and given information about how to protect themselves in an emergency.

Management strategies focus on survival during the natural disaster. Women construct elevated platforms using bedding, bed frames, and bamboo cane. They also ration food or change the type of food eaten, perhaps opting for locally-sourced vegetables instead of rice from the market. Women also dictate changes in household chore duties; sometimes men help cook and take care of the children. Migration and seeking alternative employment are also adaptive strategies. Perhaps most importantly, women can protect family assets, manage the household finances, and borrow credit preemptively. Many women in rural Bangladesh are members of microfinance organizations and have access to loans.

Recovery strategies include the rebuilding of homes and other structures, replacing livestock, securing new or restoring old sources of income, treating ill family members, and returning children to school. Women are actively involved in all these endeavors post-disaster.

The Char Livelihood Program, funded by the U.K. Department for International Development, "uses a combination of 'core' social protection approaches, such as cash for work programs…" to undertake protective and preventative interventions[250]. The Char Livelihood Program seeks to introduce community-based disaster risk management initiatives in affected villages and regions. These initiatives have already created new, sustainable livelihood opportunities in the Jamuna and Brahmaputra regions of Bangladesh[251]. Successful implementation of programs like the Char Livelihood Program offer communities access to resources otherwise beyond their means and provide stability, even in the wake of natural disasters.

[250] CLP, 2019
[251] Awal, 2013

**Nepal**

Nepal has a fragile ecosystem. The average temperature across the country is increasing at a rate of approximately 0.06 degrees Celsius per decade[252]. In the Himalayas, the temperature is rising even more quickly. Average annual temperatures rose by 0.056 degrees Celsius over the last forty years[253]. If this rate of temperature increase continues, flooding and drought will affect food security, biodiversity, and human health.

With an annual growth rate of 2.3%, the population of Nepal has doubled in the last thirty years: 13.5 million to 27.1 million people from 1975 to 2005 (UNDP, 2007). In 2018, the population reached 29.6 million[254]. Nepal ranked 149th out of 189 countries on the Human Development Index in 2017[255]. Pakistan ranked 150th[256]. On the 2017 Gender Gap Index, Nepal ranked 111$^{th}$ out of 144 countries. Pakistan was second-to-last above only Yemen[257]. In 2018, Nepal ranked 105$^{th}$ out of 149 countries. Pakistan remained second-to-last[258]. More than 80% of Nepal's population is involved in the agricultural sector. An estimated 83% of women work in agriculture[259]. Despite their contribution to the agricultural sector, only 1% of women own land[260]. Women in Nepal do not have legally-protected property or land rights. They face deprivation and are excluded from development by their low social standing. Women living in rural Nepal are fundamentally resource poor.

Gender relations in Nepal are unequal in many ways. The proportion of women holding key legislative positions, or working as senior officials or managers, was around 14% in 2008[261]. The most recent data on female literacy in Nepal is from 2011. According to the World Bank, literacy amongst women 15 years or older is 49%; however, this is contested by Nepal's own

[252] Parasai, 2006
[253] Mandal, 2017
[254] CIA World Factbook, 2019
[255] Human Development Report, 2017
[256] Human Development Report, 2018
[257] WEF, 2017
[258] WEF, 2018b
[259] World Bank, 2017
[260] Human Development Report, 2009
[261] Human Development Report, 2009

Living Standards Survey released the same year which placed female literacy at only 44.5%[262,263]. Regardless, women have less access to economic opportunity than men. This includes paid jobs or other sources of income. Most shockingly, 95% of girls have firsthand knowledge of violence. Of those surveyed, 77% were attacked by members of their own family[264].

There already exists a framework for including gender issues in development and climate change adaptation planning in Nepal. The National Adaptation Programme of Action (NAPA) was passed by the government of Nepal in 2010. It recognizes women as one of the most vulnerable segments of the population and includes a list of gender-specific vulnerabilities to climate change; however, NAPA does not provide any targeted goals for women's involvement or capacity-building. Women are still underrepresented in decision-making and no gender-specific projects have been announced[265].

Gender mainstreaming was integrated in Nepal's Five-Year Development Plan for 2003 to 2008; however, gender and caste-based discrimination remain rampant in Hindu culture and communities. Dalits and other minority ethnic groups suffer dual discrimination[266]. This is especially detrimental in rural areas where minority women live on the margins of society. In the Humla District of Nepal, the poorest and least developed of the country, communities rely on their social connections to adapt to the impacts of climate change. This includes strengthening trade relationships with nearby villages and exploring alternate employment options in other districts[267]. Minority women are excluded from these benefits.

Often, climate policies are planned and enacted without the input of women from rural communities. In Nepal, there exists legislation to ensure women's participation in the planning

[262] World Bank, 2011
[263] Nepal Central Bureau of Statistics, 2011
[264] SAATHI & The Asia Foundation, 2007
[265] Mainlay & Tan, 2012
[266] Dartmouth Journeys
[267] Onta & Resurreccion, 2011

process. The Local Self Governance Act promises women participation and representation. Even so, more could be done to strengthen this framework and to develop initiatives that target vulnerable women. This includes educational campaigns to better equip women with the skills and knowledge to meet their needs. At the national level, the Nepal Climate Change and Knowledge Management Center is responsible for providing and advising policy and development planning. They also train large institutions in capacity-building and design climate change awareness campaigns[268]. The Center is led by a woman, Jaishree Sijapati, who has authored original research on treeline shifting, climate refugees, and resilience in Nepal[269].

In 2012, the International Union for Conservation of Nature (IUCN) was approached by Nepal's Ministry of Environment to develop a national action plan on gender and climate change. The published work proposed women-run, climate-smart seed banks and reserving one-third of seats on District Forest Committees for women. The plan stressed the need for grassroots capacity-building for women's groups as a bottom-up approach yields more sustainable options and strategic actions[270]. For example, the Aama Samuha (translated as "Mother's Group") and Community Forest User groups advocate for gender equity and help women strengthen their power within existing communities or institutions. This often results in more economic opportunity and sustainable, adaptive options to combat climate change impacts for all[271].

[268] NPPKMC, 2014
[269] NPPKMC, 2018
[270] IUCN, 2012
[271] Mainlay & Tan, 2012

**Punjab, India**

Punjab is a state in northern India. It borders the Pakistani province of Punjab along its western edge. In 1947, the Punjab Province of British India was divided along religious lines to form these two distinct regions. Indian Punjab is the 20th-largest state by geographic area and the 16th most populous. In 2011, the population was recorded at a little under 28 million people[272]. Most live in rural communities. Punjab is a predominantly agricultural state with abundant water resources and naturally-occurring, fertile soil. Other industries include manufacturing, finance, and textiles.

Women are highly involved in the agricultural sector in Punjab; however, they do not own their own land. Instead, they work as agricultural laborers on the farms of others. According to the 2011 Indian census, there has been a 24% increase in the number of female agricultural laborers between 2001 and 2011[273]. This is primarily due to rural to urban migration of male family members. In addition, the mechanization of agriculture often limits women to traditional "women's work", like winnowing, harvesting, sowing, and rearing livestock. All of these jobs pay less. Combined with the burden of household chores, providing meals, childcare, and a lack of education further marginalizes women.

According to the 2011 Indian census, the ratio of the sexes in Punjab has been in a near constant decline: 895 females to 1000 males, well below the national average of 940 to 1000[274]. The overall literacy rate in 2011 was nearly 76%, with male literacy over 80% and female literacy at 70%. There is large educational disparity between men and women, particularly in rural Punjab. Of enrollments in primary school, 44% are girls[275].

Punjabi is the official language of the region and is spoken by 90% of the population. Hindi is spoken by a small percentage of the population. Hinduism is the second most popular religion

[272] Government of India, 201
[273] Government of India, 2011
[274] Government of India, 2011
[275] World Bank, 2017

in the state, at roughly 42%. Sikhism is practiced by nearly 56% of the state[276]. Although the Sikh gurus held women equal to men, in reality, there is a divergence between principle and practice. Sikh society sanctifies the patriarchal social structures in which marriage, motherhood, and service become a woman's most valuable attributes. Patriarchal customs tied to culture and religion are pervasive in Punjab[277]. They limit a woman's freedom of movement and expression, education, employment, and control of her own body. Some are enshrined in law, while others persist through local, long-held traditions, like the Hindu caste system, and male-dominated leadership.

The denial of land rights keeps landless women and female agricultural laborers on the margins of society. It also denies them credit, insurance, irrigation, and access to other agriculture-related support programs. Excluding women from their entitlements further jeopardizes the financial security of their households and community at large. Research undertaken to study the high rates of suicide amongst farmers in the state revealed troubling trends. Of the households where suicides were reported to the government, the majority were "farmer suicides", linked to an agricultural failure and subsequent deterioration in income or livelihood[278].

Farmer suicide has increasingly become a problem in Punjab. More than 900 suicides were reported between 2017 and February 2019[279]. The national government has been slow to act on the issue. Structural flaws in India's policies push farmers towards drastic measures to relieve their families of debt. The government has committed to purchase prices for nearly two dozen crops, but only regularly buys wheat and rice. Regardless of set minimum prices, farmers are left to deal with middleman and hagglers who refuse to pay them the prices set by the government. Lapses in implementation force still more in the agrarian community into debt.

[276] Ghuman, 2012
[277] Kaur, 2010
[278] Das, 2009
[279] Bharti, 2019

In the wake of a farmer's death, female family members must assume responsibility for the household. In the majority of cases, these women are the wives of the deceased. Other female members of the household are often compelled to start working outside the home for the first time as well. These working women range in age, but a large percentage were under 30 years old. The income of female-headed households is significantly less than that of male-headed households: Rs 1,137 ($16) per month as compared to Rs 1,844 ($27) per month[280].

Women have been instrumental in establishing and staffing rehabilitation and counseling centers to reduce the rate of farmer suicide. The face-to-face treatment has been shown to alleviate the symptoms associated with depression and other mental health crises. Provision of resources and facilities for those suffering is key. These services are meant to be both preventative, to help individuals find alternative solutions, and to promote understanding and reduce the stigma associated with mental illness and suicide. Treatment options, support groups, and mental health training are all provided for the farmers themselves and for family members affected by the death of a relative[281].

To address the disparities in income, women-led cooperative farms and banking systems have sprung up. Dairy cooperatives were first organized in Punjab in 1978. These societies are divided into three levels: milk producers' co-ops at the village level; a union of co-ops at the district level; and, the federation of the unions at the state level. Women play an important role in dairy farming as the primary caretakers of cattle. The Women Dairy Project helps rural women become more confident and self-reliant. There are 390 Dairy Cooperative Societies serving approximately 20,000 women[282].

The co-ops are under the Support to Training & Employment Programme (STEP) and funded by the Indian government. STEP provides administrative services for organizing and sustainability. They also generate awareness and educational campaigns for member women. Topics include

[280] Sidhu et al., 2011
[281] Jain, 2018
[282] Verka, 2016

management of the co-ops; breeding, feeding, and management of cattle; and gender mainstreaming and women's health. The goal is to expose member women to the values of economic, social, political, and legal empowerment. The co-ops also help the dairy industry in Punjab run more efficiently.

As women earn money, there is often pressure from male family members to relinquish any and all income into their possession. Without access to a bank or secure digital banking system, women may hide their earnings or be forced to surrender them. Women in small communities will instead pool their cash in an unorthodox banking system, where individuals who contribute are allowed to borrow from the shared reserve. If given the opportunity, women will also start their own small businesses or even a brick-and-mortar bank. Such was the case in 1997, when the Mann Deshi Mahila Sahakari Bank was started by a group of women living in rural Maharashtra[283]. Twenty years later, the bank announced an investment fund designed to helped other women start their own business. The Rs 100 crore ($15 million) fund will provide 10 lakh (1 million) women access to loans at reasonable interest rates. The bank has already financed women-owned businesses in dairy farming, goat and sheep rearing, fruit and vegetable markets, tea, comestibles (pickles, papad, etc.), and bicycle and automobile repair.

[283] Kumar, 2018

## VII. POLICY RECOMMENDATIONS

Pakistan has many challenges to overcome. The country was ranked 150th out of 189 countries in the 2017 Human Development Index (HDI). Between 1990 and 2017, Pakistan's HDI score rose by 39%; however, it still trails its neighbors Bangladesh and India, countries that rank 136th and 130th, respectively[284]. Pakistan has experienced the slowest improvement in human development in South Asia, only faring better than Afghanistan[285]. It is one of the world's most vulnerable countries to natural disasters; however, Pakistan only approved and passed risk reduction policies starting in 2013. The majority of internally displaced persons were forced out of their homes and communities because of environmental problems, whether from pollution, changing rainfall patterns, flooding, or drought. To this day, Pakistan does not have an environmental migration policy. The National Climate Change Policy enacted in 2012 does not address issues associated with migration either and has been in effect too short a time for systemic results.

One of the greatest challenges facing Pakistan is the institutional capacity needed to efficiently and effectively problem-solve. Determining the severity and frequency of impacts from climate change and their effects on the population are only the first steps in designing mitigation and adaptation strategy. Since the floods of 2010 and 2011 and the drought of 2014, the national government of Pakistan appears to have formulated policies to address climate change-related issues. Now, it must go a step further and implement these policies.

In Tharparkar District, the provincial and national governments have an opportunity to increase the population's resilience and reduce their vulnerability to climate change, ultimately helping decrease forced migration out of the district, which no one is prepared to manage. Strong political affiliations between ministries and officials have fostered an atmosphere of indemnity within local government. Inefficient policies and lack of coordination have further marginalized women living in rural communities. Women must be consulted on issues that pertain to them

[284] UNDP, 2018a
[285] UNDP, 2018b

and their families. Their adaptive capacity must be studied and articulated, and additional measures must be undertaken to ensure women can recover entirely and more quickly from the impacts of climate change in the future. Finally, communities must be educated about the ecological and environmental impacts of climate change and how these will affect their lives.

Women and communities most affected by climate change must be prioritized. Tharparkar District consistently underperforms on measures of education, employment diversity, and social mobility[286,287]. These measures indicate a lack of resilience due to widespread poverty that limits adaptation. Women are disadvantaged by cultural restrictions that affect decision-making, ownership of land, distribution of resources, literacy, and access to services. Improved access to any of the five types of capital (financial, social, natural, infrastructure, or human) would reduce women's vulnerabilities to the impacts of climate change (See Figure 29). There is an urgent need to better the lives and livelihoods of women by improving disaster management and coping strategies in rural Tharparkar District.

**Stakeholders**

There are numerous stakeholders involved, including those responsible and at risk. They have varying levels of interest and influence at the national, provincial, or local levels (See Figure 30). Stakeholders have an important role to play in the formulation and implementation of policy across social levels and geographies. The different actors involved, their opinions on the issues under review, and their capacity to mobilize resources, determine how or if the problems are resolved. In this case, the issue is reducing the vulnerabilities of women living in rural communities to climate change impacts.

First, women and communities are stakeholders in their own respects. Women living in rural areas are the most directly impacted by climate change; therefore, they are also the most affected by policy changes or improvements in their rights, livelihoods, or living conditions.

[286] USAID, 2014
[287] FRDP, 2018

Given their participation in work in agriculture and in the home, as well as the constraints placed on them by culture, religion, and society, they are the primary stakeholders in this matter.

Informal leaders in communities have high influence, but low interest in improving the lives of women in their sphere of influence. Often, empowering women results in a loss of power and authority for male elders or the abandonment of long-held traditions. Informal leaders can be landowners or families of higher social standing unwilling to participate, because they fear losing control over land and other natural resources. This includes feudal landlords who often control local sacred sites and hold positions of power within the local government.

Local non-governmental organizations (NGOs) have been established to address women's empowerment and gender inequality in Tharparkar District. Their main goal is to provide services to reduce the vulnerability of women. This may include the impacts of climate change or may be limited to economic opportunities, maternal and neonatal health, or nutrition. Their programs often involve the creation of local, women-led groups that convene to discuss a certain topic, share advice, and support each other. The NGOs aid where possible but are primarily engaged in educating women in rural areas. Local NGOs have moderate interest and influence in addressing climate change-related issues unless created to do so. For example, the Association of Physicians of Pakistani Descent of North America raises money for the installation of water wells in communities in the Thar Desert[288]. Another example is the collaboration between the Shifa Foundation, which is based in Islamabad, and the Health and Nutrition Development Society (HANDS), based in Karachi. Together, these organizations carry out emergency nutrition actions in 44 union councils across Tharparkar District[289].

The government of Sindh Province has high interest and high influence in the matter. With the passage of the 18th Amendment, devolution of power to the provincial governments was

[288] APPNA, 2019
[289] UNICEF, 2015

accompanied by significant budget allocations. The government of Sindh Province has the responsibility to pass policies on gender issues that protect women and improve their lives. The body has acknowledged the challenges faced by women in Tharparkar District and their vulnerability; however, without the definition of clear legal roles, vested interest, and political pressure little action has been taken. Informal institutional barriers at all levels, inefficiencies, and redundancies have made policy implementation nearly impossible.

The Sindh Commission on the Status of Women also has a high interest, and relatively high influence, on the issue. The Commission was created to examine the efficacy of policies undertaken by the government on women's empowerment, political participation, and representation. The chair of the Commission was reserved for a woman. Since its inauguration, the Commission has been attempting to implement its strategic plan and transition several districts to women-friendly models[290].

Sindh's Women Development Department should also be involved in all women-centric laws or initiatives. The department is charged with initiating and implementing policies and projects for women's social, economic, legal, or political empowerment. It is also responsible for educational campaigns and raising awareness about the rights of women in society[291].

Prime Minister Imran Khan acknowledges climate change as the foremost challenge to Pakistan. As a candidate for office, his platform to combat climate change relied on planting more than a billion new trees across the country. He also argued that any future development planning should be climate compatible and enhance the country's resilience. In regard to water scarcity, Khan favored conservation and the construction of dams for water storage. His double-pronged approach would rely on a media campaign to guide water usage and a series of dams along the Indus in Punjab Province; however, the latter has long been opposed by provinces that share the Indus River with Punjab. Downstream, Sindh Province suggests that the construction of

[290] Provincial Assembly of Sindh, 2015
[291] WDD, Government of Sindh, 2018

dams in Punjab Province would allow the latter to store and use more than its share of water. Although Khan is attuned to issues of climate and water access, he has yet to link them to his defining political issues in his rhetoric[292].

The Women's Parliamentary Caucus was established in 2008 by the first woman speaker of Pakistan's National Assembly, Dr. Fehmida Mirza. It is an unprecedented and historic body that unites parliamentarians from all party affiliations. The Caucus is charged with strengthening representation of women at all levels of government and to be a voice for women's issues. The Caucus acts to ensure all legislation, policy, and programs are responsive and monitored accordingly[293].

The mission of Pakistan's Environmental Protection Agency is to prevent pollution, protect the environment, and promote sustainable development through research, initiatives, and technological innovation. The EPA has come under criticism recently for its lack of an active action plan, its lack of capacity, and lack of political will. The delegation of environmental management to the provinces as a result of the 18th Amendment resulted in serious mismanagement and environmental degradation. The transference was unaccompanied by a proper or consistent procedure for the establishment of provincial environmental agencies. Climate change has remained under the purview of the national agency, with the Ministry of Climate Change.

The Ministry of Climate Change has high interest and high influence as well. The Ministry's sole purpose is to protect Pakistan and its people against the adverse impacts of global climate change. Hence, it is invested when communities suffer under the impacts of extreme weather events or other climate change-related disasters. The Ministry is responsible for formulating adaptation strategies to address disaster preparedness, capacity-building, and institutional resilience. They also do strategic mitigation planning for the country.

[292] Dawn, 2019
[293] WPCPK, 2019

The Provincial Disaster Management Authority (PDMA) is the final body within Pakistan with high interest and high influence. The Authority formulates and implements disaster preparedness and recovery policies across Sindh. It also supplements any relief efforts undertaken across the province and often intervenes before disasters, like drought-related famine, are acknowledged by the national government. The PDMA is under the jurisdiction of the National Disaster Management Authority, which released a new National Disaster Response Plan in March 2019[294]. The previous update to the NDRP came in 2010. The NDRP-2019 is a framework for developing detailed plans and policies to cope with natural and climate change-induced disasters.

The Pakistan Armed Forces are the sixth largest in the world and the largest of any Muslim country[295]. The Armed Forces have three main branches: Army, Navy, and Air Force. They play a vital role in maintaining order in the nation. The Armed Forces have been integrated into civil society since the country's independence in 1947. The military has built much of the country's infrastructure, including dams, bridges, canals, and power stations, and is the leading innovator in energy development. In times of natural disaster, army engineers, medical personnel, and servicemen provide rescue, relief, and supply efforts. They have the technical capacity to provide aid in unprecedented circumstances and the knowledge to improve day-to-day life for millions.

Research organizations have little power and moderate interest. They have undertaken studies, written reports, provided recommendations, and consulted on policy proposals applicable to the lives of women and the impacts of climate change. This includes work by the Social Policy and Development Center and Leadership for Environment and Development.

[294] NDMA, 2019
[295] Pakistan Army, Government of Pakistan, 2019

International non-governmental organizations work towards strengthening the role and participation of women in society. This includes economic opportunities, maternal and neonatal health, disease treatment and prevention, nutrition, water access, and more. The United Nations Women mission, the World Bank, The International Labor Organization, UNICEF, World Health Organization, International Union for Conservation of Nature, and others are all working within Pakistan and Tharparkar District. The efficacy and permanency of their work depends on the political will of national and local leadership. They have a moderate interest and low influence.

**Objectives**

In order to improve the lives of women in rural Tharparkar District and reduce their vulnerability to the impacts of climate change, concerned parties must take immediate action. This includes all levels of government, the cooperation of international non-governmental organizations, the support of other countries, and the inclusion of Thari women. Pakistan must take the necessary steps to target the underlying reasons why women living in rural communities are most vulnerable, as has been done in Bangladesh, Nepal, and Punjab, India. Lessons-learned in case studies from other countries should inform the identification and prioritization of policy objectives. The Pakistani government must strengthen institutions, prioritize women's empowerment, invest in education and health systems, and support research and technological innovation. These measures will lessen the challenges faced by women in rural communities. To achieve the goal of reducing Thari women's vulnerabilities to climate change, five policy objectives have been identified:

1) Strengthen the provincial government's commitment to mainstreaming gender and promotion of gender equality in all development policies;
2) Improve coordination, planning, and implementation between the provincial, district, and national institutions;
3) Construct infrastructure in communities, as well as at the district and provincial level, for augmenting access to resources and economic opportunities;

4) Enhance communities' and villages' resiliency and capacity to manage climate change impacts; and
5) Provide access to information about climate change impacts and disaster reduction management at the community, district, and provincial level.

To guarantee execution of the proposed solutions, a strong monitoring and evaluation system will need to be established. This is especially important in Tharparkar District where public interests are regularly disregarded in favor of the political elite. Monitoring and evaluation will keep the work on track and ensure it does not fail. Quantifiable and substantive indicators of achievement can be identified for each objective (see Figure 31).

The provincial and district governments will work in cooperation with other organizations, such as UN Women. The responsibility of evaluating progress against stated objectives and goals will lie with the government; however, international actors or local non-governmental organizations should monitor to ensure accountability and transparency.

***Improving Grassroots Capacity-Building***

Women's integration into Pakistan's urban and rural economies is a desirable goal to improve equity, efficiency, and the country's overall economic growth. Women rely on natural resources to run their households. They are already equipped with basic knowledge in the sustainable and equitable use of these natural resources, which is imperative to the formulation of any climate change adaptation strategies at the local level; therefore, capacity-building and community involvement are essential. Capacity-building at the grassroots level is notably different from capacity-building at the institutional level in Pakistan. For communities or non-governmental organizations working in Tharparkar District, capacity-building means improving an individual's ability to participate, problem-solve, and change their lives for the better[296].

[296] UNDP, 2009

An initiative to improve the livelihoods of livestock-dependent farmers was organized by the Pakistan Agricultural Research Council[297,298]. Its goal was to improve owners' technical skills and encourage them to be more market-oriented. Although it was focused in the districts of Sanghar and Shaheed Benazirabad, it is equally applicable for Tharparkar District. Livestock training and farm management programming were organized to help women develop their disease prevention and control, as well as farm sanitation, hygiene, and feeding, skills. The Thardeep Rural Development Programme works specifically with the most vulnerable and poor women in society who live in the most deprived and remote areas of Sindh. Tharparkar District is one of their main areas of concern. Current initiatives involve human resource development. These initiatives build the community's capacity by harnessing their potential and pre-existing skills in training workshops and interactive sessions[299].

To further the work already being done in Tharparkar District, the provincial government, in collaboration with local non-governmental organizations, must invest in capacity-building for women in rural communities. Programs should be designed to include institutional capacity-building with stated legal requirements and objectives. There must be a system in place to ensure rules and regulations are adopted. Additionally, technical knowledge of disaster-reduction and management procedures must be improved. External, international support is essential to foster a favorable social and economic environment for women. Some background research must also be conducted. Studies must determine common knowledge gaps held by farmers, especially women working in agriculture. The many roles of women, and their associated responsibilities, also need to be identified.

A new agency to address institutional and human capital capacity gaps should be established. Capacity gaps result from disparities between an organization's objectives and goals and their ability to achieve those goals. Personnel working on climate change or women's issues must have the necessary technical skills and expertise. Training workshops held in communities can

[297] IFPRI, 2012
[298] PARC, 2019
[299] TRDP, 2015

encourage group participation to identify potential risks and hazards associated with climate change. Interactions amongst peers can help women better prepare themselves in times of distress. While these measures result in an improvement in technical skills and the formation of adaptation measures, they are accompanied by administrative and investment costs. In addition, given the structure of society in Tharparkar District, social and cultural barriers will hamper the involvement of some women. Resistance within rural communities to specific recommendations that defy patriarchal norms may pressure women to avoid enrollment in particular groups.

***Improving Livelihoods in the Agricultural Sector***

Women living in rural communities involved in agriculture do not have access to the latest technologies or techniques. Illiteracy and the lack of services for women affect crop production, livestock management, poultry husbandry, fish farming, and other forms of employment. Female farmers are not granted access to mechanized farm equipment. Instead, they perform most of the labor manually, which increases their relative workload. This ultimately affects their productivity and wages[300].

Social relations are defined as the structural connections that create and reproduce systemic differences in the positioning of different groups of people[301]. These relationships determine the tangible and intangible resources available to those groups. There is a clear division of labor, with respect to what is considered "productive" work, in Tharparkar District. Women's work is less valued because it deals with the home rather than the cash economy[302]. However, without the meaningful participation of women, community adaptation projects fail because women have a broader impact on conservation than men[303]. Identifying the roles and activities attributed to women outside the home is imperative. In Tharparkar District, women save income by sourcing firewood and fodder from trees or shrubs. To complete these chores,

[300] FAO, 2015
[301] Gellman & Turner, 2013
[302] Hamid & Afzal, 2013
[303] LEAD, 2013

women travel a distance of 4 to 5 kilometers every day[304]. Women also weave mats and rope or make handicrafts. In some villages they play a large part in horticulture by picking, weeding, and peeling[305].

In Tharparkar District, households range from patriarchal to extended families. In patriarchal households, a single male is considered head of the family, but all male members dominate. In extended families, two or more generations live together. These types of family structure define the role women have within and outside their home. Over the last two decades, the balance of power and responsibility has shifted as more men from rural areas have migrated to urban centers in Sindh Province in search of work. This has led to a corresponding increase in the workloads for women[306].

Pakistan must identify the underlying causes of gender inequality not simply with respect to the household and family, but across institutions, the state, and the markets. At the national level, the Ministry of Climate Change is responsible for drafting and implementing country-wide policies. While the Ministry did release the first National Climate Change Policy in 2012, provincial ministers assert that the policy was not circulated to all pertinent organizations. Provincial governments also claim that the general policies laid down in the national draft cannot be implemented at the local level because of geographic, cultural, and economic differences[307]. The overall lack of policy implementation related to climate change and gender prevents the progress of future development objectives.

Since the rural economy in Tharparkar District is primarily agrarian, agricultural markets are the economic heart of the district. Rural markets may not have storage facilities or awareness of market trends. There is also a shocking lack of enforcement of current legislation pertaining to markets. Along the long chain of marketing, from production, distribution, to consumption, the

[304] UN, 2014
[305] FAO, 2015
[306] FAO, 2015
[307] Noshirwani, 2012

primary beneficiaries tend to be middlemen and retailers. For example, a farmer may receive Rs.08 per kilogram for an onion in the local village, but retailers can charge Rs.25 per kilogram to customers at urban markets[308].

Tharparkar District will continue to suffer from natural and human-induced disasters: floods, drought, extreme rainfall, saltwater intrusion, cyclones, and earthquakes[309]. These events destroy cropped land and kill livestock, which have huge implications for the lives and livelihoods of the local populace. This loss of resources and assets, and the absence of alternative sources of income, will force already vulnerable groups, most especially women and children, into worse poverty. Land rights will become more important as the frequency and severity of disasters increases. First, land rights must be defined. Second, where pre-disaster conditions were already characterized by inequality and insecurity, post-disaster relief and responses must create more secure tenure rights for marginalized women[310].

The Sindh provincial government has taken several steps to ensure women are allotted an equitable share of land, most notably the Sindh Land Distribution reforms in 2012[311]. They have also undertaken disaster-reduction measures and invested in resilience-building to improve the susceptibility of women. A holistic approach to alleviate the hardships faced by women has yet to be proposed or implemented. Gender issues have received recognition, but have yet to be fully incorporated into decision-making regarding agriculture.

The government of Sindh Province and local non-governmental organizations, like the Sindh Rural Support Program, advocate public-private partnerships within Tharparkar District to raise awareness about women's contribution to agricultural production. This would also create a market for women to earn greater profits. Agricultural extension programs are an essential component of any activities undertaken. These must take place at the Union Council or village

[308] Tagar, 2014
[309] PDMA, 2013
[310] Oxfam, 2011
[311] Pakistan Institute of Labour, Education & Research - Karachi, 2017

level, rather than in larger towns or urban areas. Extension programs aimed at women will educate women on new techniques for crop production, livestock rearing, forestry, poultry, or fisheries. The government and private sector can promote cottage industries with skill workshops and provide access to financing.

Creating and accessing new markets is especially important for women who are not allowed to cross geographic or cultural boundaries by themselves. In 2010, the Pakistani government introduced a cash transfer mechanism called the WATAN card. Initially intended to compensate flood victims, the card faced technical and administrative challenges when released. It did not make funds easily accessible, nor was it properly monitored. Also, the population it was intended to serve remained largely ignorant of its existence or purpose[312]. Were this WATAN card and fund transfer system to be improved, with more robust monitoring and information campaigns, it could appreciably benefit women in rural areas. To do so, there must be coordination across all levels of the implementation process, capital investment in the development and provision of technologies, and the creation of strong and supportive legal frameworks. This poses a challenge as there already exist considerable barriers when attempting to coordinate ministries or efforts at the grassroots level.

***Improving Migration Policy***

According to the Internal Displacement Monitoring Center, the majority of internally displaced persons in Pakistan were forced to move because of environmental disasters[313]. Yet Pakistan does not have an environmental migration policy. Pakistan must first develop a national policy covering both internal and international migration. Currently, the only relevant legislation is the emigration law passed in 2009. This does not deal with internal migration or displacement. The National Climate Change Policy of 2012 does not address these issues either[314]. In truth, Pakistan seems to reject the idea of human displacement to climate change-related or natural events. A policy on migration would better serve communities post-disaster, rather than the

[312] Khan, 2013
[313] IDMC, 2019
[314] Global Change Impact Studies Centre, 2012

current trend of reactive action on the part of the government. Authorities at all levels must address the root causes of migration to prevent communities from relying on migration as a solution of last resort. The policy must, therefore, be drafted to preempt forced migration. Instead, it should frame migration as an adaptive measure in the context of development goals[315].

Policies on environmental migration can be addressed via two different, but complementary, pathways. The first protects migrants and their communities of origin. The second covers adaptation to climate change through migration[316]. In the case of Pakistan, even if only at the district level, the first step is the collection of data and the analysis necessary to discern migration patterns. Until 2017, Pakistan's most recent census was from 1998. In that report, the motives for migration were listed as education, marriage, business, employment, transfer of employment, returning home, and health, amongst other more nebulous categories. Environmental migration was not included. Provisional results from the 2017 census do not include statistics on migration.

**Protecting Communities of Origin**

Measures must be taken to reduce communities' vulnerability to environmental risks: disaster risk management, poverty reduction, and resilience and social protection[317]. Disaster risk management will reduce the impacts of climate change in Tharparkar District. Risk, in this case, is a function of communities' degree of vulnerability, exposure to damaging events, and the frequency and severity of those events[318]. As developing countries' susceptibility to climate change-related natural disasters increases, so too does the importance of the country's disaster risk reduction policy. Until 2005, Pakistan had no such policy in place. All efforts were reactive emergency relief. The National Disaster Management Authority (NDMA) was created in 2006. It is responsible for policy and institutional coordination. The NDMA has jurisdiction over the

[315] ADB, 2012
[316] Sattar, 2014
[317] ADB, 2012
[318] NDMA, 2013

Provincial Disaster Management Authority (PDMA) and the District Disaster Management Authority (DDMA).

The DDMA is the first responder in event of an emergency. The PDMA implements the policies and plans made at the national level and coordinates response efforts. Until 2012, there was no coordination between the different levels of authority. Responses were unplanned, mismanaged, and ineffective. Mismanagement of the relief efforts after the floods of 2010 and 2011, and the many lives lost as a result, became the basis for the National Risk Reduction Policy enacted in 2013. According to the NDMA, "[t]he policy shall promote priority measures to ameliorate existing vulnerabilities to hazards and ensure that future development initiatives add resilience. The policy also seeks to provide guidelines for timely, dedicated and adequate investment on hazard mitigation and preparedness interventions at all levels which will not only substantially reduce the disaster risk but also the consequential damages and economic costs associated with response, recovery and rehabilitation"[319].

This policy was insufficient to mitigate the drought crisis in Tharparkar District in 2014. There are low levels of institutional risk awareness and knowledge. The dynamics of risk remain relatively unknown to many in Pakistan, as are best practices for mapping or analyzing it. Models of risk assessment, vulnerability, hazards, loss, and damage must all be developed. The ability to collect sound data and the capacity to compile it are needed.

Lack of coordination between agencies along the chain of command was a key factor in the delay in recognizing the drought in Tharparkar District in 2014 and authorizing the necessary emergency relief efforts. This issue must be addressed by increasing capacity at all levels, delegating responsibility more clearly, and opening lines of communication between district and national authorities. The NDMA cannot only have a policy-making role. It should also have the capacity to provide support and assistance to other authorities to better implement risk reduction actions. Provincial and district agencies must have the capacity to carry out risk

[319] NDMA, 2013

reduction actions by themselves. For this redistribution of accountability to be effective, information must pass quickly and clearly between the levels. Officials in Tharparkar District must be granted the authority to categorize conditions within its borders to activate necessary measures as soon as possible.

To preempt the need for reactive natural disaster management, future development planning and policies should be accompanied by a natural disaster risk assessment. For example, the Sindh Resilience Project, a collaboration between The World Bank and the PDMA, will, "support the restoration and improvement of embankments at high risk sites along the Indus for protection against riverine floods as well as construction of small rainwater-fed recharge dams in drought prone regions in Sindh"[320]. The project will simultaneously, "mitigate flood and drought risks … and strengthen Sindh's capacity to manage natural disasters."[321]

The construction and maintenance of disaster reduction infrastructure must be integrated into all future disaster risk management policy. Structural investments might include the restoration or improvement of existing flood embankments or irrigation systems to increase the resilience of communities to floods or drought. Economically productive agricultural areas should be a priority, as should already disadvantaged communities. Coupled with investments in infrastructure, the capacity to evaluate these structures must be enhanced. This will require a large financial investment and technical expertise. Investment without the necessary, trained staff will lead to further inefficiencies and the construction of defective infrastructure, which may pose an additional risk to the communities it is meant to serve. Disaster reduction infrastructure is not expected to be immediately accepted by communities either. Communities distrust local government and its officials.

Political feasibility may also be a challenge as Tharparkar District is a poor district and infrastructure of any kind requires a large financial investment. In poor communities in a poor

[320] Sindh Irrigation Department, 2016
[321] World Bank, 2016

district, allocation of public funds is a source of great tension. Therefore, poverty reduction strategies must be a priority. Families, communities, and the district as a whole must be lifted out of poverty. Living conditions and measures of human and economic development must improve.

Just as the impacts of climate change and environmental migration increase poverty, so too can poverty reduction policies affect climate change and induce migration. For example, economic development in urban areas has increased rural to urban migration; however, at the same time, the influx of people, pollution of industry, and lack of environmental regulation has caused migration the other way, from urban to rural. Those suffering the health effects of poor air and water quality may move out of the city to escape the deteriorating environment.

The movement of people, goods, and wealth that accompanies migration highlights the need for resilience and social protection measures. Long-term measures must be undertaken to increase the resiliency of communities in Tharparkar District to make lives and livelihoods more sustainable and profitable, and to prevent forced migration. In Tharparkar District, this will mean investment in water infrastructure: water treatment or desalination plants, or irrigation systems. Improving communities' financial resources will also relieve privation during seasons of low rainfall or crop failure. For example, low interest rate or conditional loans or grants that would only need to be repaid if there was no crop failure. Conditioned cash transfer (CCT) welfare programs dependent on medical appraisal or school attendance could also raise the standard of living[322]. So too would investment in health facilities: hospitals, clinics, veterinaries, dispensaries, and mobile units. Communities in Tharparkar District must also find new sources of income. Given that agriculture is the main source of income, new income sources ought to include the introduction of new varieties of crops that are more resistant to heat, salt water, or do not require watering.

[322] TRDP, 2014

Finally, migration must be considered as an adaptive measure. There are two types of migration: forced migration and planned migration. Planned migration by those who want to move should be considered an adaptive strategy, especially in areas that are extremely and recurrently vulnerable to climate change[323]. This migration includes pre-emptively moving communities. In such cases, the government relocates the community and supplies new housing. Plans for relocation are approved by the community and the villagers participate in the process. Public authorities fund basic services, vocational retraining, or agriculture re-establishment. Capacity-building is at the heart of these initiatives to generate new income as soon as possible after the transition.

In Tharparkar District, seasonal migration has long been a part of life, but pre-planned migration was non-existent. The mismanagement of the drought in 2014 demonstrated the lack of preparation at the national, provincial, and district level. Pakistan's response to drought has been stop-gap arrangements[324]. Any established contingency plans have fallen through. The cycle of drought relief begins with the declaration of emergency, followed by analysis of the situation. If it is deemed an emergency, then wheat and other relief goods are meant to be provided immediately[325]. No permanent action is laid out beyond these ad-hoc relief plans. After the crisis of 2014, awareness of the need to move beyond stop gap arrangements to a strategy that preemptively addresses the problem rose. This situation prompted a proposal for the creation of the Thar Development Authority. This new agency would be responsible for implementing policies involving water, livestock, health, and poverty[326]. The fate of the Thar Development Authority remains in limbo, and internal migration has yet to receive the analytical or policy attention it warrants.

[323] Sattar, 2014
[324] Consortium Management Unit, 2014
[325] PDMA, 2014
[326] Khangharani, 2014

**Implementation**

The most successful policies must combine capacity-building and the improvement of livelihoods in the agricultural sector. This combination will address issues of economic empowerment for women in Tharparkar District most directly. It also manages the social and cultural reasons why women are particularly vulnerable. Increasing capacity-building can provide women in rural communities with technical knowledge and skills to prepare for future climate-related disasters. Skill development and technical knowledge are complementary and will increase equity. It is also cost-effective, as it builds on already existing programs and structures, and is administratively feasible. Addressing gaps in one component would automatically lead to greater efficiency of the other and vice versa. Combined with improvements in the agricultural sector, women will be better equipped to deal with vulnerabilities resulting from social, cultural, and economic barriers. These changes may face opposition from feudal lords and political elite, who distrust the shifting balance of power within communities. For this reason, the implementation process will have to ensure access and effective service delivery. The Sindh Commission on the Status of Women must work with the Ministry of Climate Change, the Provincial Disaster Management Authority, and the provincial government in coordination alongside international actors like the United Nations, World Bank, U.K. Department for International Development, USAID, and others.

Stakeholders must work together on specific initiatives meant to improve the social and economic status of women. This might include gender-sensitization workshops in communities and the workplace. Micro-credit programs and Community Investment Funds (CIFs) for entrepreneurship will have to be employed by the Sindh Commission on the Status of Women. CIFs will give women living in poverty more power in the economic process through management of their own funds and small businesses. To provide the funding, budget allocation for social schemes and investment in infrastructure will have to be included in the next provincial budget. Capacity-building and institutional strengthening require training individuals who will work in the field to reduce vulnerability and engage women in economic activities. These measures require money allocated from the Ministry of Finance. Capacity-

building, in particular, requires a large budget; therefore, backing from the national government will also be necessary. Support from international organizations will also be needed to fund project interventions confronting the impacts of climate change and building resilience within Tharparkar District.

Legitimization, resource mobilization, organizational design, and monitoring and evaluation determine if a policy is successfully implemented. Legitimization requires stakeholders with high interest and high influence to acknowledge the problem and the validity of the people's concerns. In this case, the provincial and national government must recognize women's vulnerabilities to the impacts of climate change as a threat to more than just the poor, rural communities where these women reside. The government and relevant stakeholders must assume responsibility and commit to resolving the issue. Once commitment has been given, policy solutions proposed, and a course of action determined, financial allocation and investment are necessary. This is resource mobilization. It includes, but is not limited to, support from the provincial and national governments. International organizations must also be persuaded to fund interventions, deploy personnel, and build infrastructure to tackle climate change and build resilience within the district.

Currently, women lack representation at all levels, within their communities and in national governance. In order to effectively serve the female population and increase their access to resources, the needs of women must be represented in decision-making. This involves mainstreaming gender into all policies, not just those related to climate change. Without redesigning organizational structures, women will remain marginalized members of society, no matter how many resources or personnel are deployed to problem-solve. To ensure women are afforded equity and equality, monitoring and evaluation must be rigorous and routine. This may be carried out by the Provincial Disaster Management Authority, with technical and policy assistance from domestic institutions like the Social Policy and Development Center, as well as international organizations to ensure transparency and objectives are met (See Figure 31 & Figure 32).

## VIII. DATA GAPS & UNCERTAINTIES

Information reviewed for this report included accounts of impacts on the health, prosperity, and well-being of women in rural Tharparkar District due to climate change. Using these cases and other data and analyses, vulnerabilities were identified that result in more frequent and severe impacts. Unfortunately, data gaps or lingering uncertainties make it difficult to quantitatively assess impacts on the lives and livelihoods of women living in Tharparkar District. Ultimately, these limitations prevent the comprehensive evaluation of potential impediments to Pakistan achieving its Nationally Determined Contribution and the country's resilience to climate change. It is important to discuss and provide perspective on any and all data gaps or uncertainties that hinder that assessment.

Due to time and resource constraints, there remain a number of questions left unanswered by this report. These questions should be the focus of future research. Future studies should address: registering women in Tharparkar District for National Identity Cards; hostility to gender equality and women's empowerment activism from other women in Thari communities; the relative benefits of pursuing women's rights through religious or secular frameworks; the rise of the women-led "piety movement"; and, the growing power and presence of the Pakistani military.

National Identity Cards are required to vote, open a bank account, apply for a driver's license, and, in some cases, receive medical treatment in Pakistan. In many rural areas of Pakistan, women are not registered by their family members with the government and cannot do so themselves because of intimidation from male relatives. These women are not legally recognized. It is difficult to predict the implications for local or national politics in Pakistan if and when more women register for National Identity Cards and exercise their right to vote.

There remains considerable resistance amongst women in Tharparkar District to policies and programs meant to improve their lives and livelihoods. Long-held traditions, patriarchal customs, and family pressure may make them hesitant to adopt new behaviors inside or

outside the home. Women may even be openly hostile to others in their community who adopt new norms. The full extent of actions taken by neighbors to limit or curb the adoption of new practices by other women is difficult to characterize but would offer evidence to improve the implementation of gender-based policies or programs in communities in Tharparkar District.

Conservative movements have also reached Tharparkar District. In response to secular feminist activism, Pakistan has witnessed the development of the "piety movement". These faith-based organizations encourage women to exercise agency and develop autonomy in a non-Western style. The organizations have a different definition of empowerment and womanhood. Women are taught to submit to and obey their husbands in all things. Adherents of these tenets avoid some of the shame and threats regularly endured by secular activists, while gaining acceptance and influence within their communities.

The rise of conservative and radical movements is indicative of prevailing sentiments within Pakistan. In an atmosphere opposed to western ideology and gender roles, it may be advantageous to consider pursuing women's empowerment and advocating for women's right from a religious, rather than secular, perspective. Although secular frameworks are not opposed to religion, they do oppose the fusion of religion and government. However, this distinction is lost on some. Instead, researchers and aid organizations may need to redefine their goals with religious principles in mind.

Finally, the influence of the Pakistani military in civic life. The military has become stronger and more entrenched. It controls large parts of the national government and sets political priorities. It also controls the economy. Several candidates in the 2018 Pakistani elections came from extremist and militant sectarian groups. Along with its presence in politics, the military is more evident in citizens' lives. The Pakistani military has appropriated large swaths of land from farmers and other underprivileged communities in rural areas. Instances of forced evacuation, the imposition of a curfew, and intercepting food and aid to villagers are all standard tactics employed by the military in the name of national security to force communities to forfeit their

land. As the Pakistani military and its leaders acquire more land, influence, and wealth, it is difficult to predict their potential future role in the adaptation and mitigation of climate change and its impacts across the country.

This report is not a comprehensive human health and risk assessment. It does not identify villages or population centers within Tharparkar District more susceptible to water scarcity, illness, or disease. It does not estimate the extent of exposure or estimate the frequency of human health impacts beyond those reported in the literature. It does not analyze the spread of diseases associated with climate change, nor does it examine the current prevalence of waterborne diseases and other illnesses. The report does not make recommendations for improving human health beyond the provision of basic medical services and trained personnel. Detailed recommendations should be sought from a medical professional, health and aid workers on-the-ground, and the academic community, and should be considered another important question for future research.

As in any literature review, there are several challenges inherent in synthesizing pre-existing works on a topic: focusing the scope of the review; the non-existence or inaccessibility of literature on subtopics; the exclusion of women from certain fields of research; and, determining the reliability of sources. Ensuring any and all literature is relevant to the proposed research question requires extensive investigation and evaluation, which can exclude or neglect relevant papers. This literature review was narrowed to a specific time period and district within Pakistan in the hopes of avoiding these errors; however, the omission of some relevant literature is inevitable and may result in undesirable gaps in knowledge. This omission is in part the result of literature that is primarily authored either by men or by non-domestic organizations. Important questions may go unasked or unanswered simply because researchers are unaware of what factors are the most applicable to women living in rural Tharparkar District. More troubling, research may be biased by an organization's, government's, or individual's viewpoint or sample pool. This may invalidate results and obfuscate the reality. Finally, data collection and evaluation in isolated, rural communities is difficult. This limits the

amount of literature generated on a topic or any subtopics that may have been at the heart of this assessment. For example, the national government of Pakistan has taken more than twenty years to release its 6$^{th}$ Population and Housing Census. Previously, the most up-to-date census was from 1998. Such lapses restrict the full characterization of climate change-related impacts.

## IX. CONCLUSIONS

This literature review provides background and context for analysis of the vulnerabilities of women living in rural Tharparkar District to the impacts of climate change. The involvement of women in the agricultural sector is greater than that of men but remains largely unacknowledged. Women are engaged in many activities inside and outside the home that are susceptible to the adverse effects of climate change, water collection being the prime example. Given the unequal distribution of resources in Tharparkar District, between men and women and between landowners and the poorest members of society, the local and national governments must introduce gender-inclusive policies and take immediate action. The government must examine the failure of pre-existing policies to improve the social, political, and economic status of women in Tharparkar District. An overview of current socio-economic, political, and institutional challenges reveals the truth of day-to-day life for women in the district, the adversity they face, and the struggle of achieving women's empowerment. Policy alternatives to address these challenges are provided.

Case studies of Bangladesh, Nepal, and Punjab, India display gender dimensions of climate change in multiple contexts. These provide example strategies or interventions that have been successful elsewhere and may be replicable in Tharparkar District. Efforts to mainstream gender and establish a space in which women can become part of the decision-making process are discussed. This report recommends capacity-building at the grassroots level, improving agriculture-reliant livelihoods, and evaluating the importance of environmental migration. Due to current inadequacies in existing legal frameworks and political processes, the lack of funding, and cultural norms, the likelihood of systemic change is uncertain. However, financial investment and political commitment to the proposed strategies could have a considerable positive effect on the social and economic status of women in Tharparkar District.

# Understanding the Impacts of Climate Change on Water Access and the Lives of Women in Tharparkar District, Sindh Province, Pakistan: A Literature Review, 1990-2018

# Appendix I. Figures and Tables

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Submitted in conformity with the requirements for the degree:
Master of Science, Environmental Sciences and Policy

Johns Hopkins University
Washington, District of Columbia
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**Master's Committee**
**Advisor: Dr. Amardeep Dhanju**
**Dr. Daniel Zachary**


**Figure 1.** Satellite map of Pakistan. Source: Maphill ©2011


**Figure 2.** Geopolitical map of Pakistan. Source: Geology.com ©Geology.com

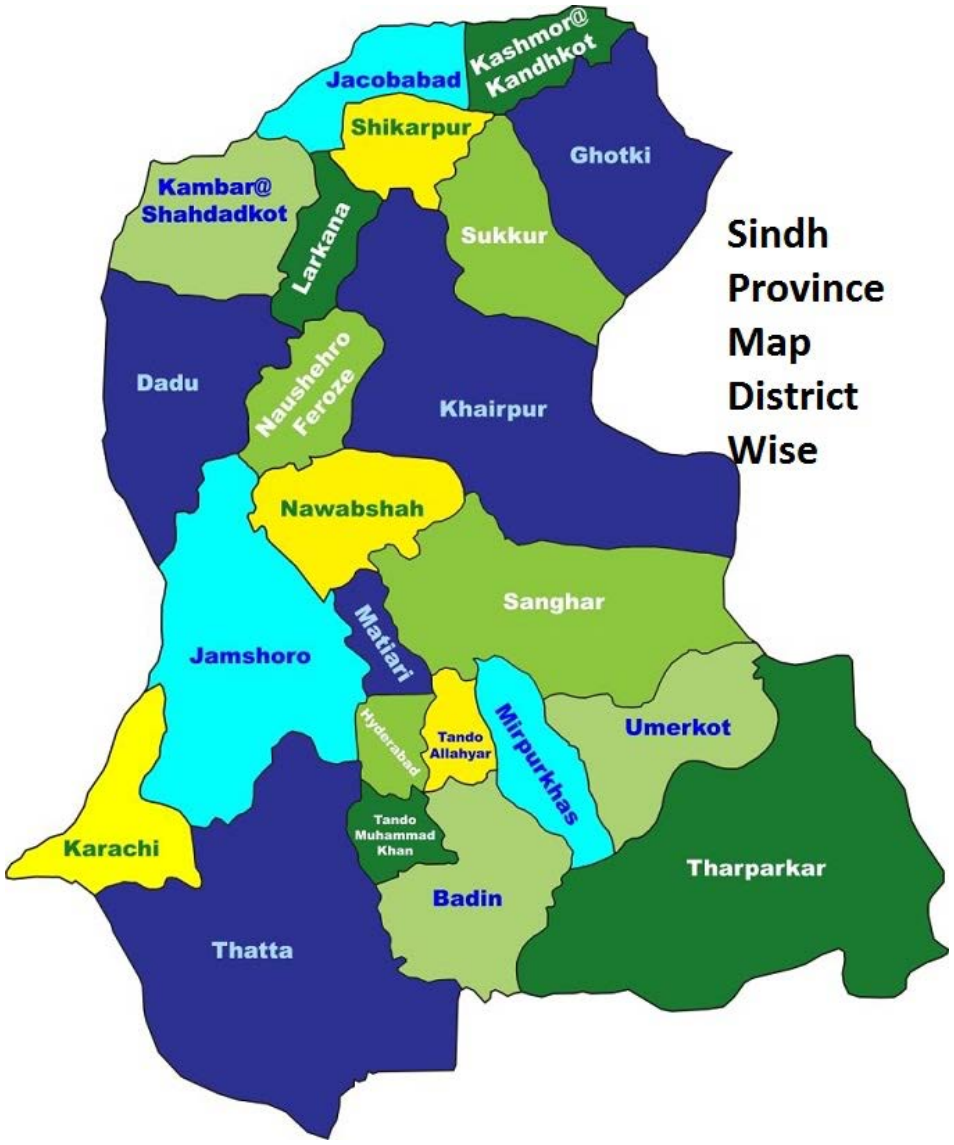


**Figure 3.** District map of Sindh Province, Pakistan. Source: [Government of Sindh]


**Figure 4.** Satellite image of Sindh Province, Pakistan. Source: Google Earth ©2019


**Figure 5.** Satellite image of Tharparkar District, Sindh Province, Pakistan.
Source: Google Earth ©2019

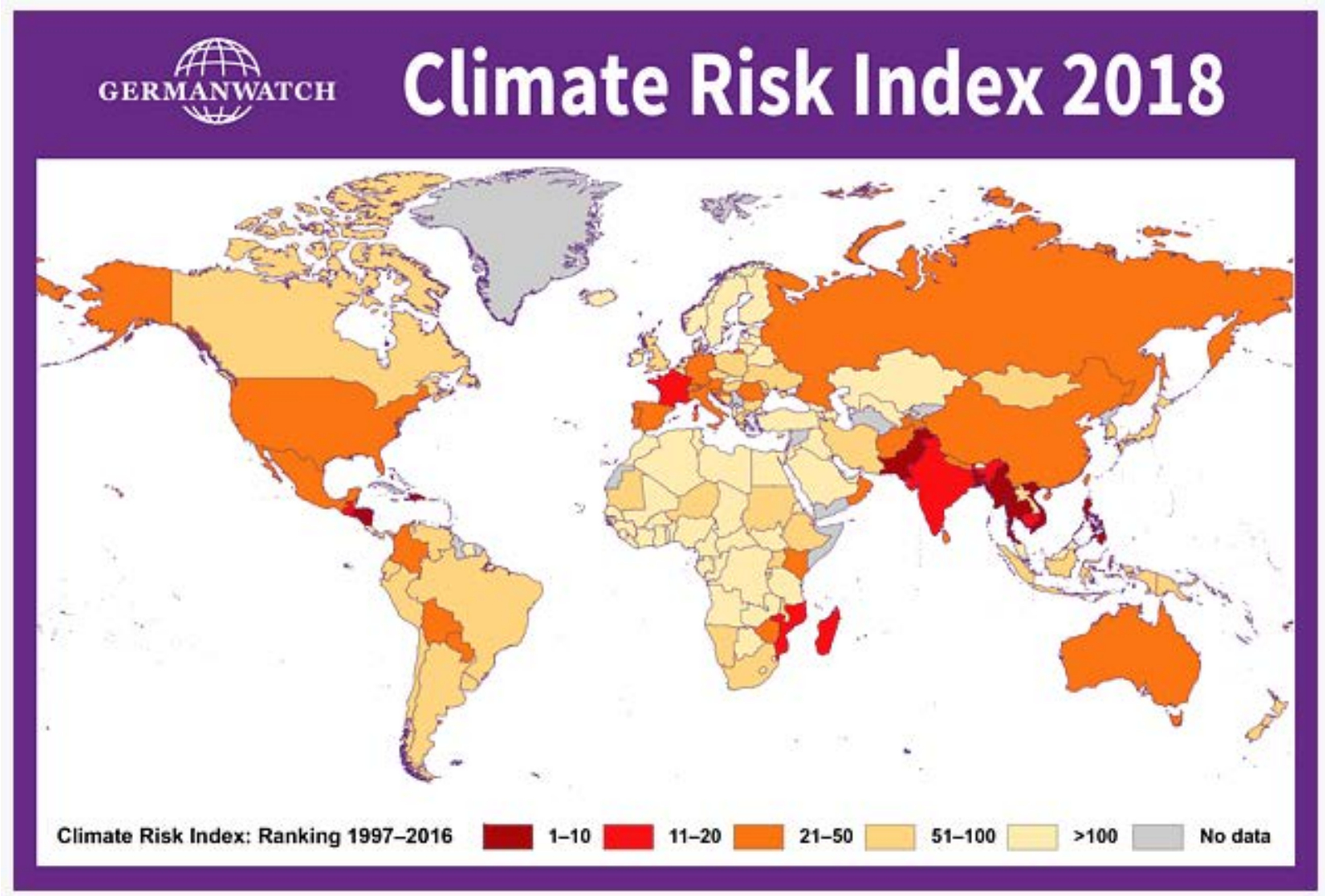


**Figure 6.** Global Climate Risk Index 2018. Source: Germanwatch

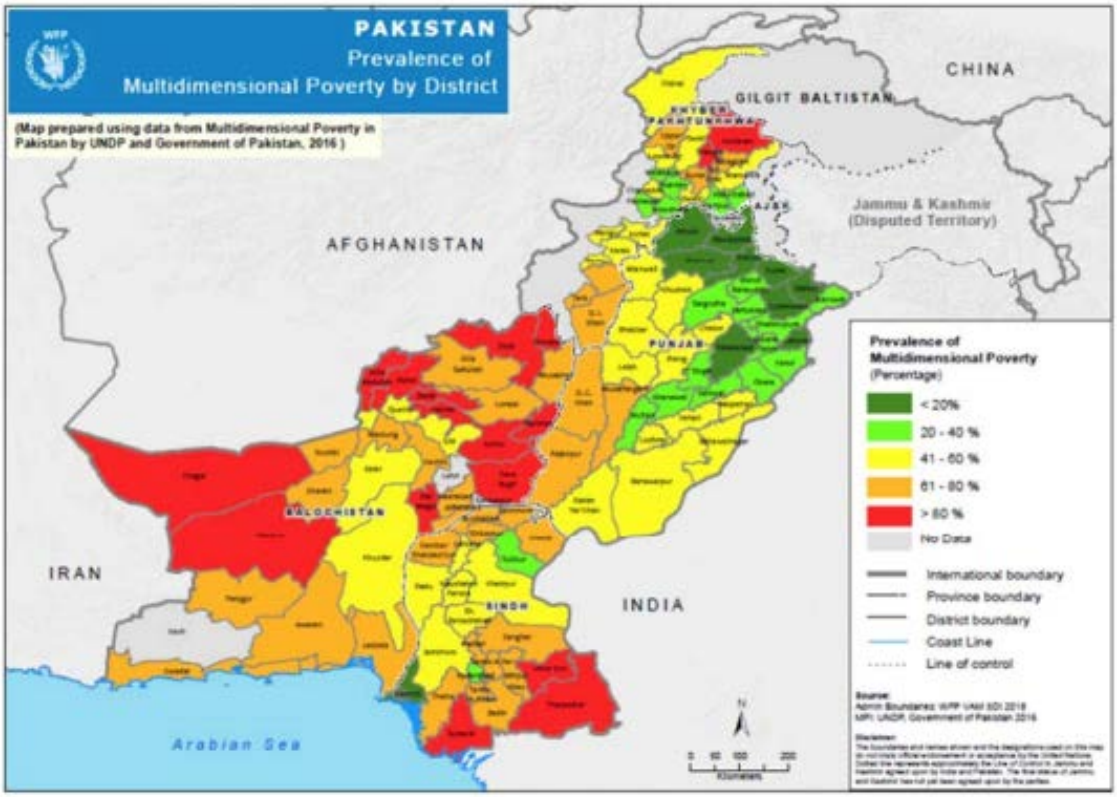


**Figure 7.** Prevalence of multidimensional poverty by district.
Source: World Food Programme, 2017

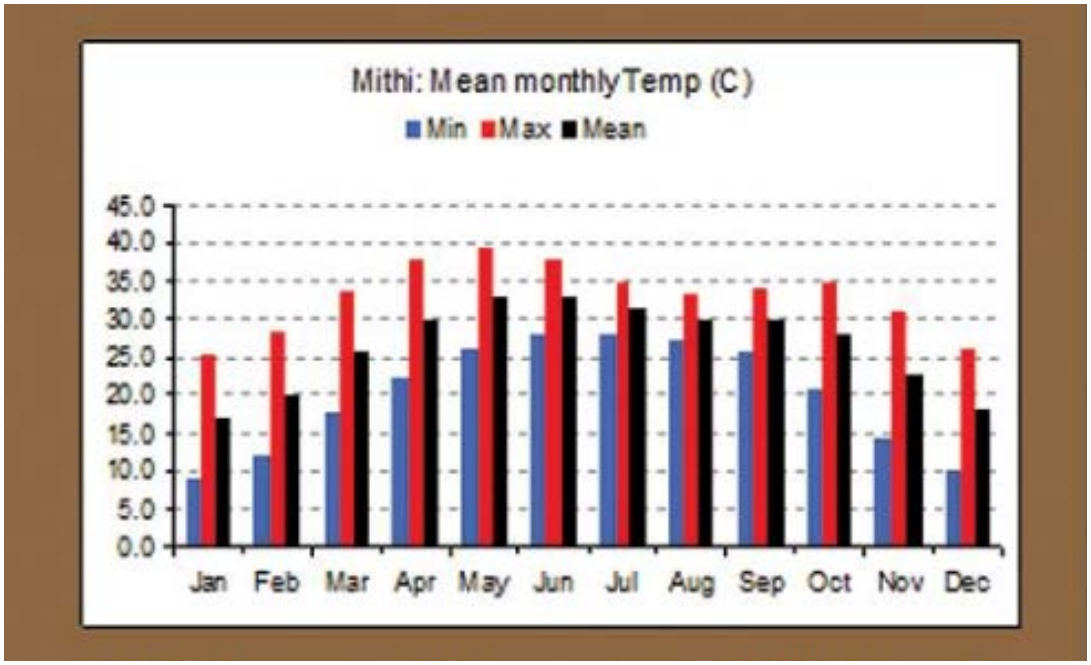


**Figure 8.** Mean monthly temperatures of Mithi, Tharparkar District, Sindh Province, Pakistan. Source: Hanif & Ramey, 2014

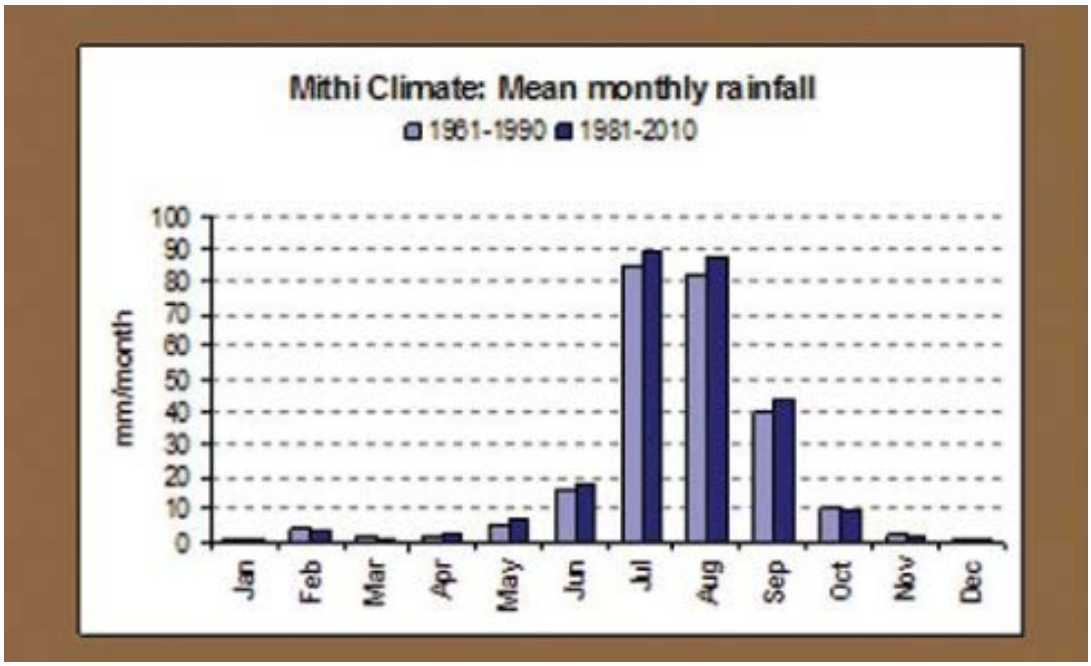


**Figure 9.** Mean monthly rainfall of Mithi, Tharparkar District, Sindh Province, Pakistan. Source: Hanif & Ramey, 2014

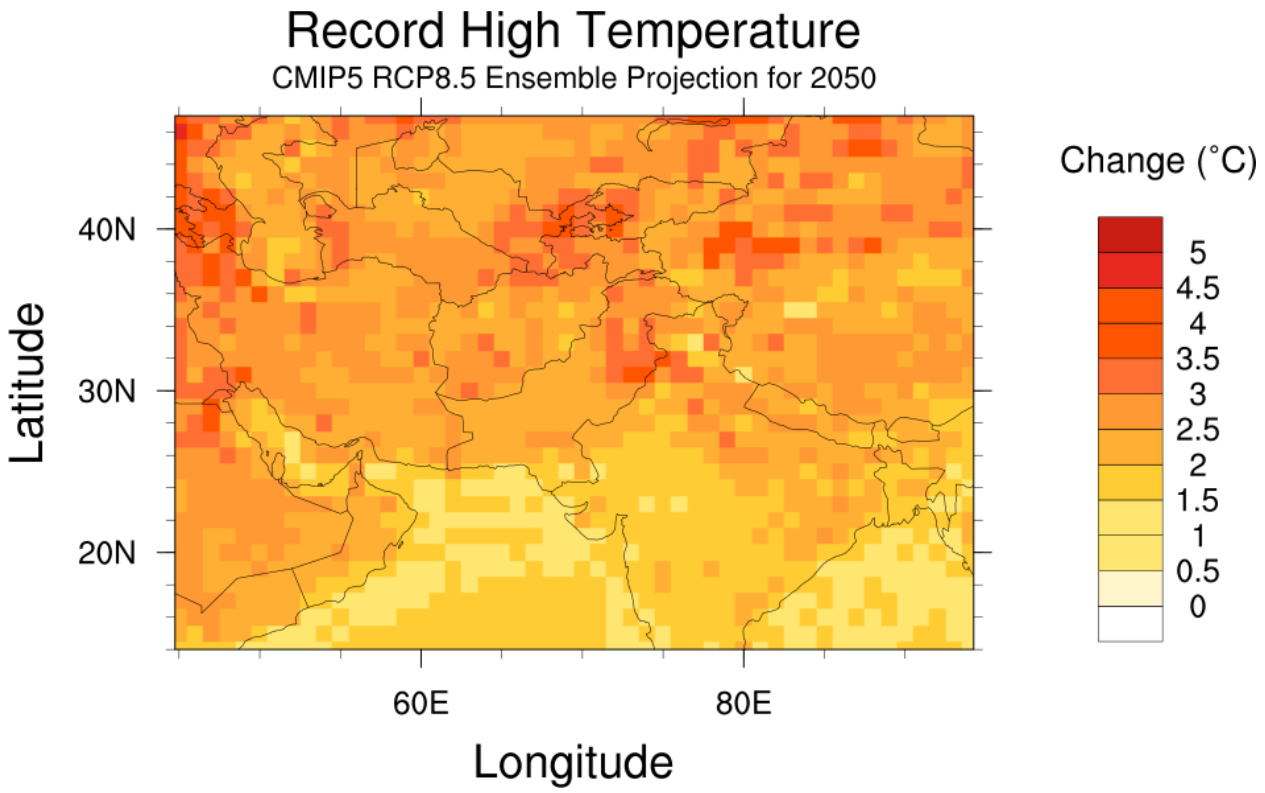


**Figure 10.** Projected Record High Temperatures for South Asia under Climate Change Coupled Model Intercomparison Project Phase 5. Source: [Climate Knowledge Portal]

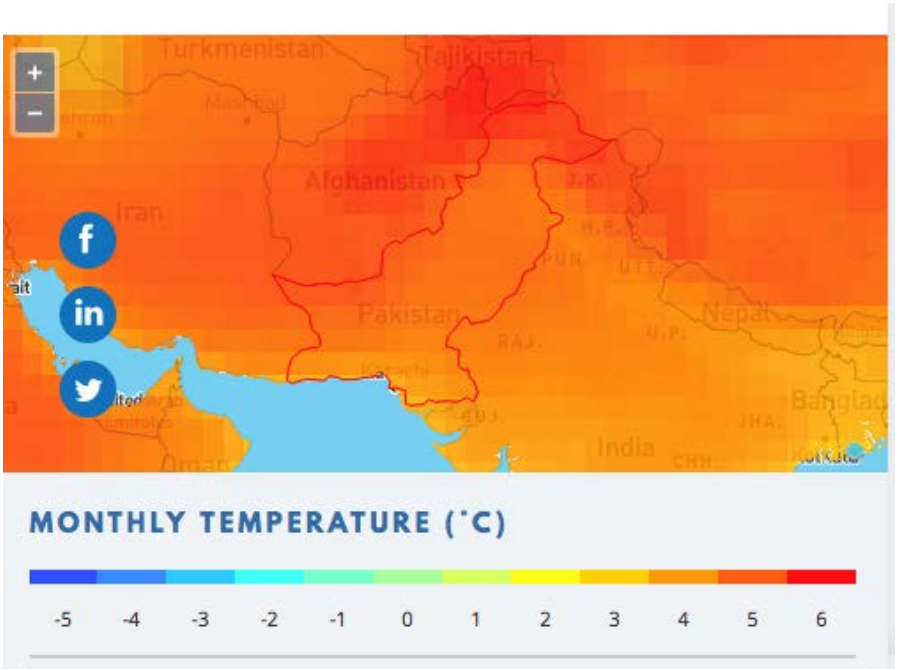


**Figure 11.** Projected change in monthly temperature of Pakistan for 2080-2099 (as compared to 1986-2005). Source: [Climate Knowledge Portal]

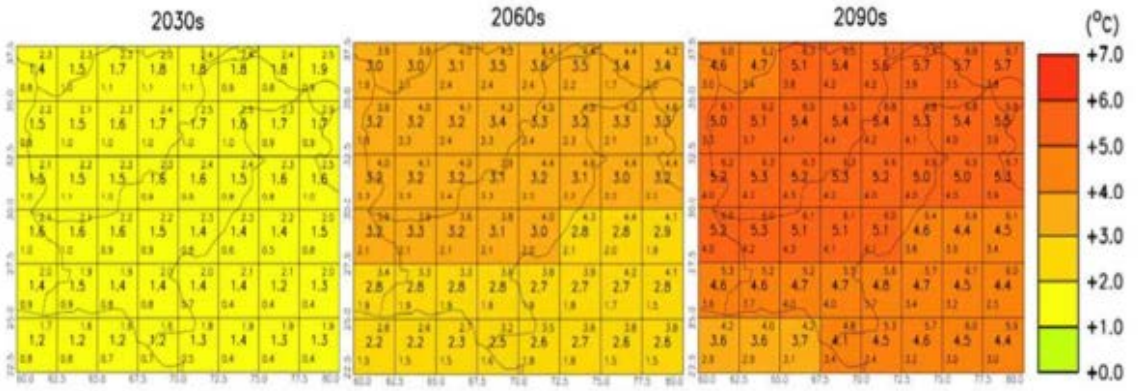


**Figure 12.** Mean annual temperature projections for Pakistan.
Source: [World Food Programme, 2017]

| MITHI Temperature | Base | Projected | % change From | Projected | % change from | % change from | Projected | % change from | % change from |
|---|---|---|---|---|---|---|---|---|---|
| | 1981-2010 | 2011-2020 | Base | 2021-2030 | Base | 2011-2020 | 2031-2040 | Base | 2021-2030 |
| Annual | | | | | | | | | |
| Average | 26.60 | 27.72 | 4.19 | 28.10 | 5.62 | 1.37 | 28.35 | 6.56 | 0.89 |
| Minimum | 20.08 | 21.10 | 5.11 | 21.40 | 6.60 | 1.42 | 21.55 | 7.35 | 0.70 |
| Maximum | 33.13 | 34.35 | 3.67 | 34.75 | 4.88 | 1.16 | 35.15 | 6.09 | 1.15 |
| Winter | | | | | | | | | |
| Average | 18.33 | 19.83 | 8.16 | 20.18 | 10.07 | 1.77 | 20.70 | 12.91 | 2.58 |
| Minimum | 10.23 | 11.25 | 9.93 | 11.55 | 12.87 | 2.67 | 11.85 | 15.80 | 2.60 |
| Maximum | 26.43 | 28.40 | 7.44 | 28.80 | 8.95 | 1.41 | 29.55 | 11.79 | 2.60 |
| Spring | | | | | | | | | |
| Average | 29.57 | 30.80 | 4.17 | 31.15 | 5.36 | 1.14 | 31.73 | 7.32 | 1.86 |
| Minimum | 22.10 | 22.95 | 3.85 | 23.25 | 5.20 | 1.31 | 23.8 | 7.69 | 2.37 |
| Maximum | 37.03 | 38.65 | 4.37 | 39.05 | 5.45 | 1.03 | 39.65 | 7.07 | 1.54 |
| Summer | | | | | | | | | |
| Average | 31.14 | 32.63 | 4.79 | 32.95 | 5.82 | 0.98 | 33.88 | 8.81 | 2.82 |
| Minimum | 27.23 | 28.40 | 4.32 | 28.70 | 5.42 | 1.06 | 29.2 | 7.25 | 1.74 |
| Maximum | 35.05 | 36.85 | 5.14 | 37.25 | 6.28 | 1.09 | 38.55 | 9.99 | 3.49 |
| Fall | | | | | | | | | |
| Average | 25.33 | 26.70 | 5.43 | 27.10 | 7.01 | 1.50 | 27.75 | 9.58 | 2.40 |
| Minimum | 17.50 | 18.70 | 6.86 | 19.00 | 8.57 | 1.60 | 19.4 | 10.86 | 2.11 |
| Maximum | 33.15 | 34.70 | 4.68 | 35.10 | 5.88 | 1.15 | 36.12 | 8.96 | 2.91 |

**Table 1.** Annual and seasonal temperature scenarios for Mithi, Tharparkar District, Sindh Province, Pakistan. Source: [Hanif & Ramey, 2014]

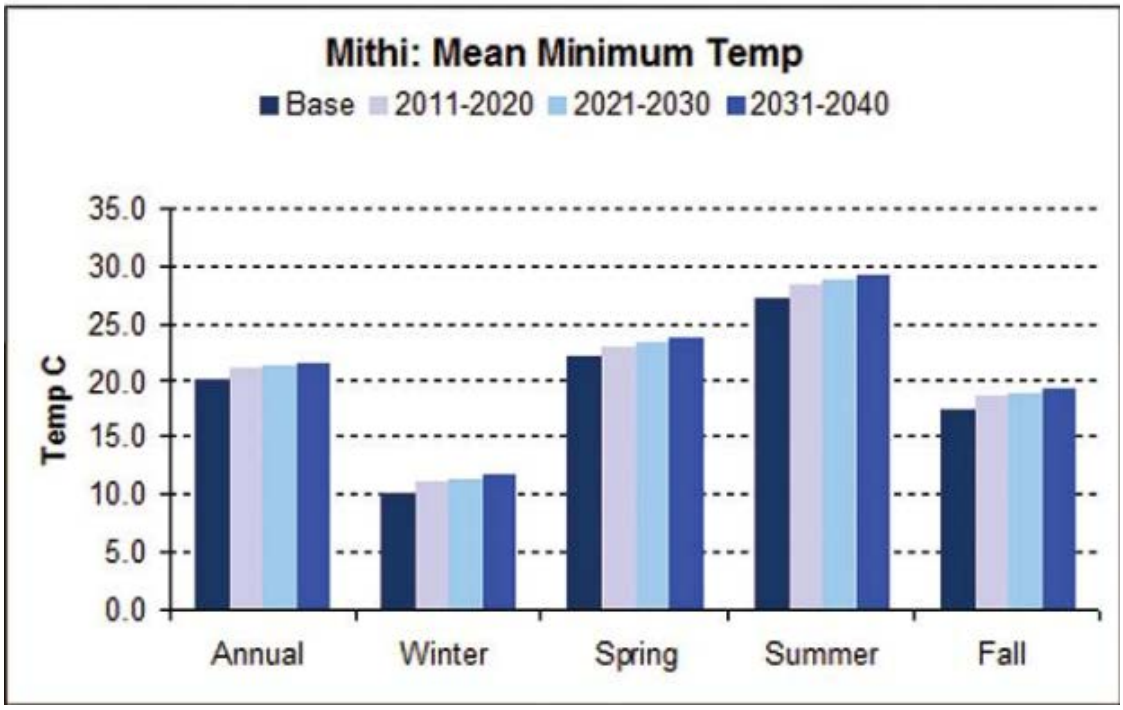


**Figure 13.** Projected mean minimum temperature scenarios through 2040 for Mithi, Tharparkar District, Sindh Province, Pakistan. Source: Hanif & Ramey, 2014

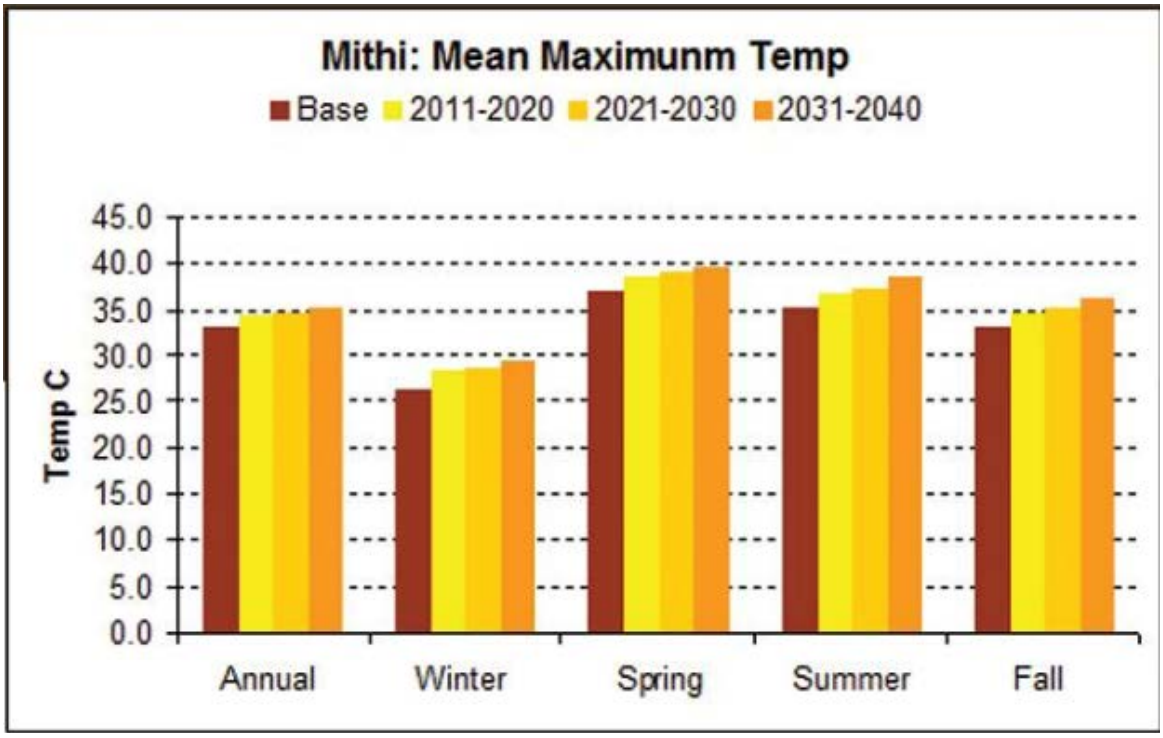


**Figure 14.** Projected mean maximum temperature scenarios through 2040 for Mithi, Tharparkar District, Sindh Province, Pakistan. Source: Hanif & Ramey, 2014

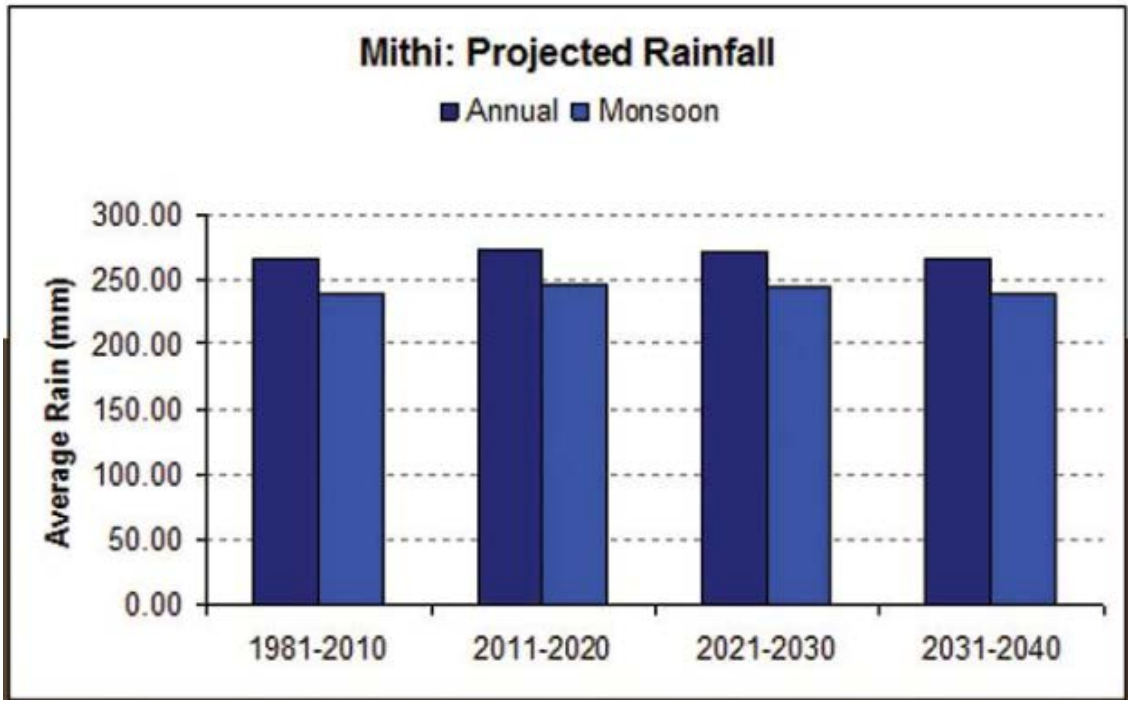


**Figure 15.** Projected annual and monsoon rainfall scenarios through 2040 for Mithi, Tharparkar District, Sindh Province, Pakistan. Source: Hanif & Ramey, 2014

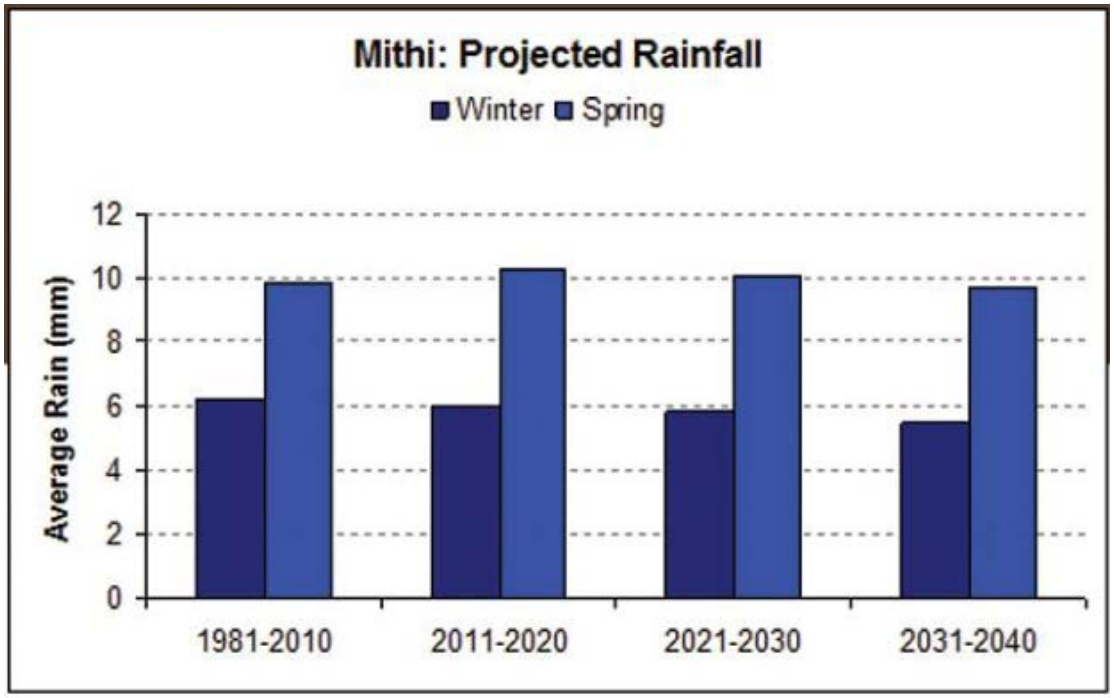


**Figure 16.** Projected winter and spring rainfall scenarios through 2040 for Mithi, Tharparkar District, Sindh Province, Pakistan. Source: Hanif & Ramey, 2014

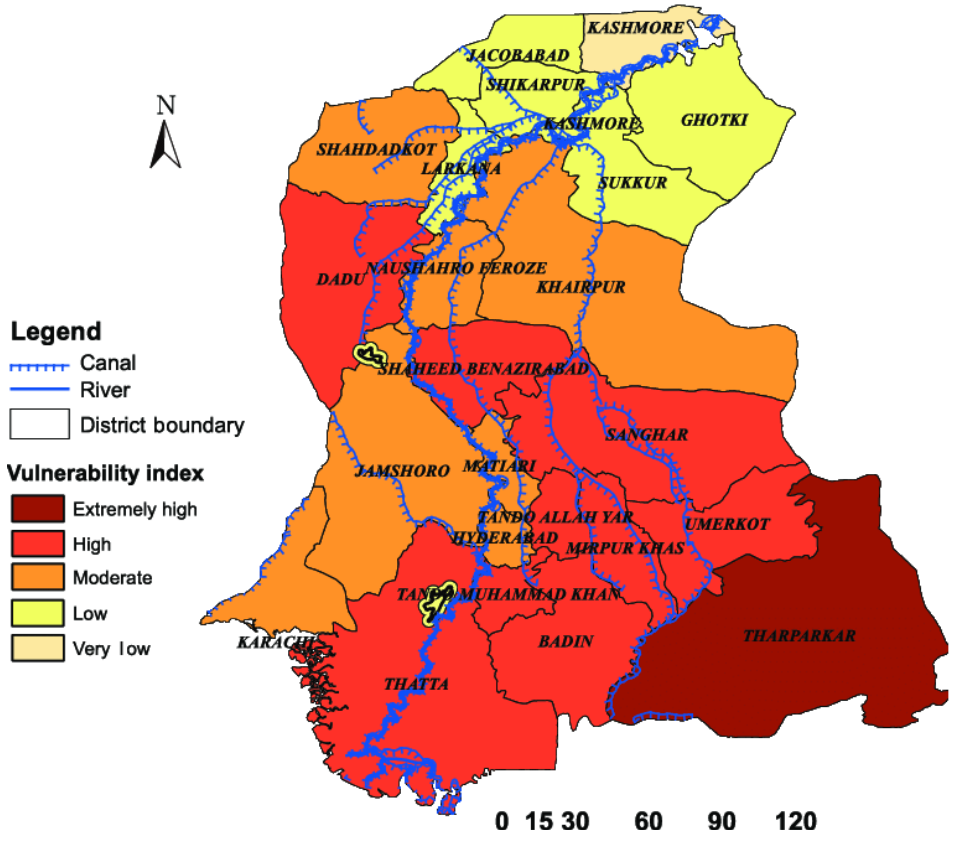


**Figure 17.** Drought vulnerability index for districts in Sindh Province, Pakistan. Source: [Adnan & Ullah, 2015]

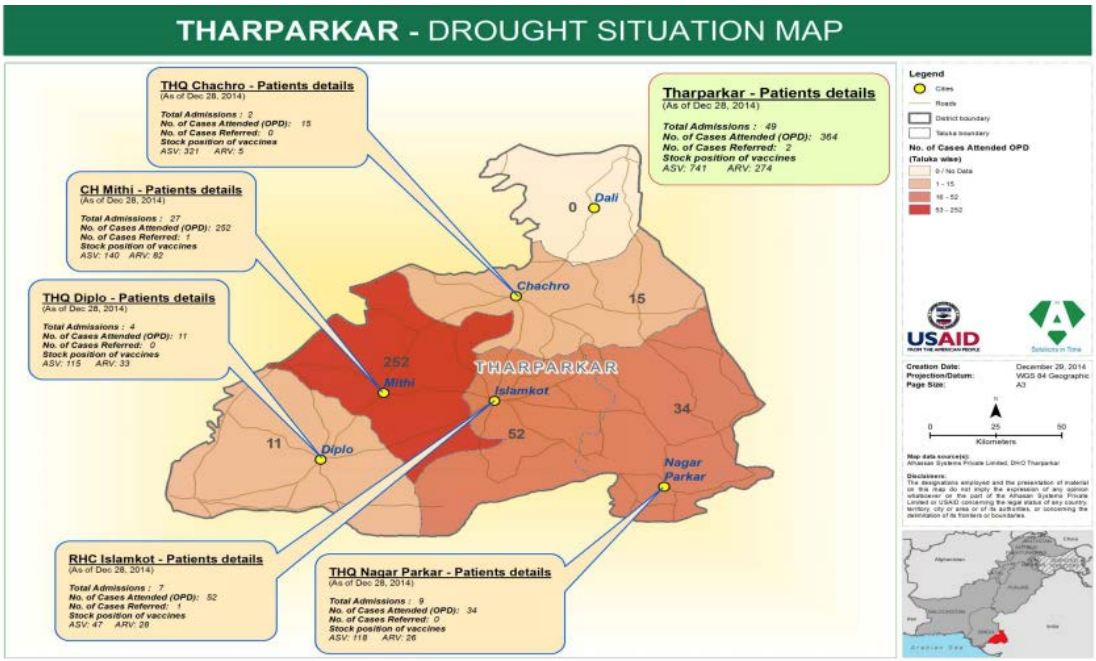


**Figure 18.** Tharparkar drought situation map as of December 28, 2014. Source: [US AID, 2014]

| Month | Deviation from average rainfall in 2013 | Deviation from average rainfall in 2014 |
|---|---|---|
| March | -89% | -17% |
| April | +82% | -18% |
| May | -100% | -98% |
| June | +292% | -40% |
| July | -83% | -84% |
| August | +50% | -17% |
| September | -41% | -99% |

**Table 2.** Percent deviation from average rainfall during monsoon (March to September) 2013 and 2014 in Tharparkar District, Sindh Province, Pakistan.
Source: Pakistan Meteorological Department

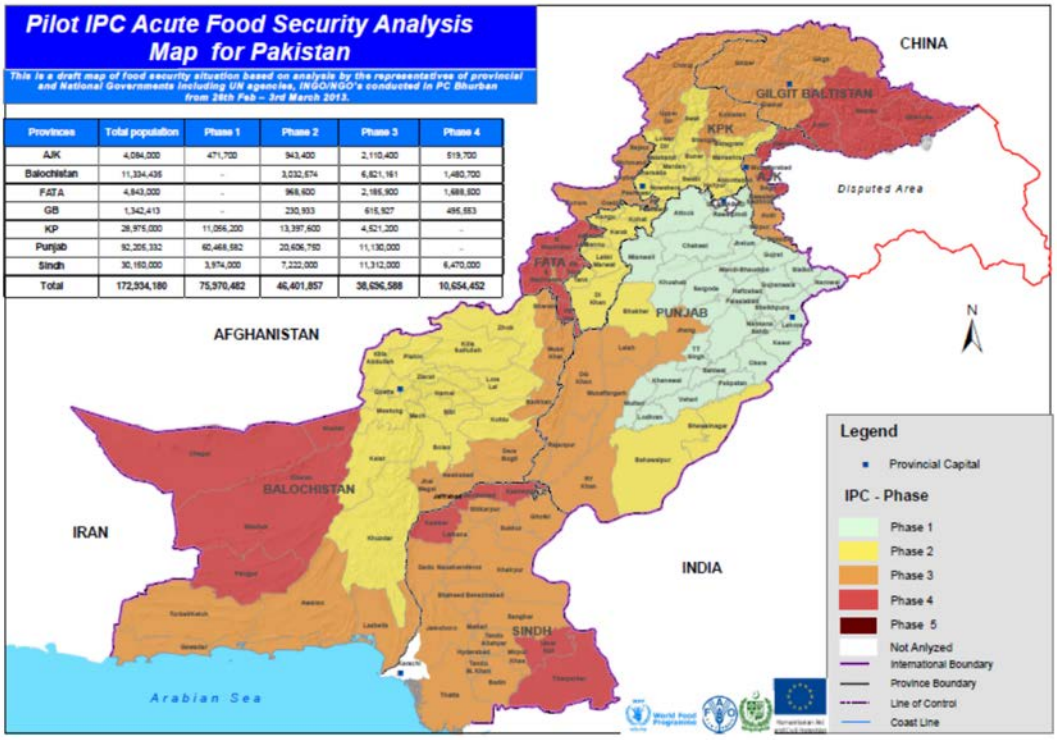


**Figure 19.** Map of acute food security analysis for Pakistan. Source: Ali et al., 2017

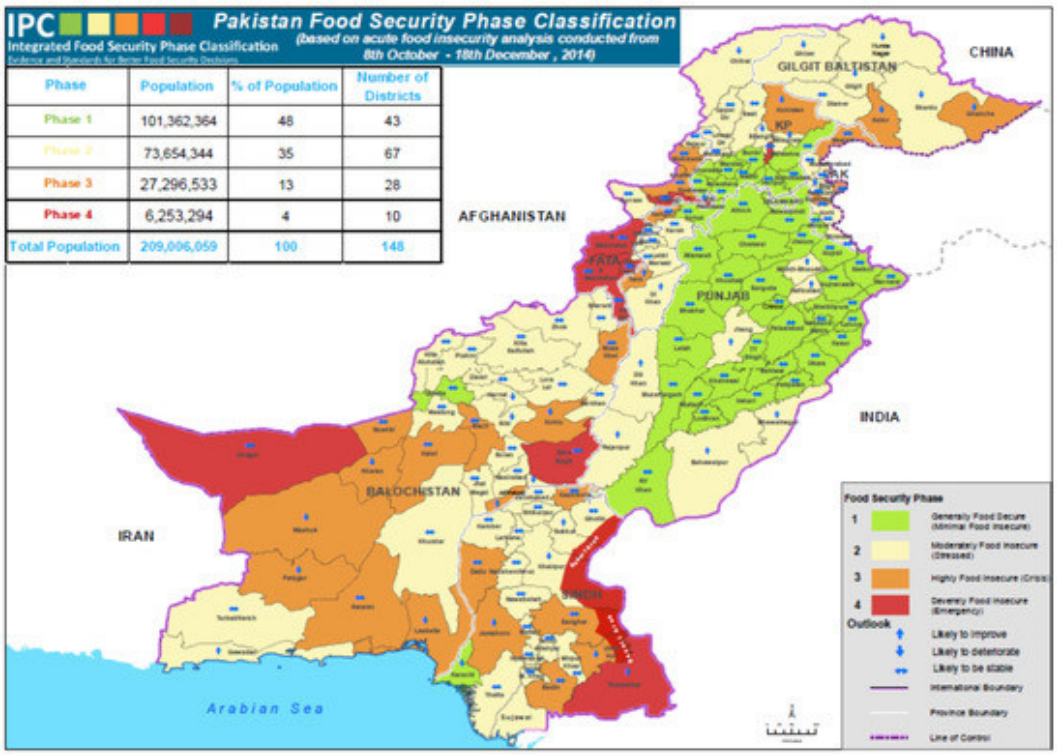


**Figure 20.** Map of food security phase classification for Pakistan. Source: Ali et al., 2017

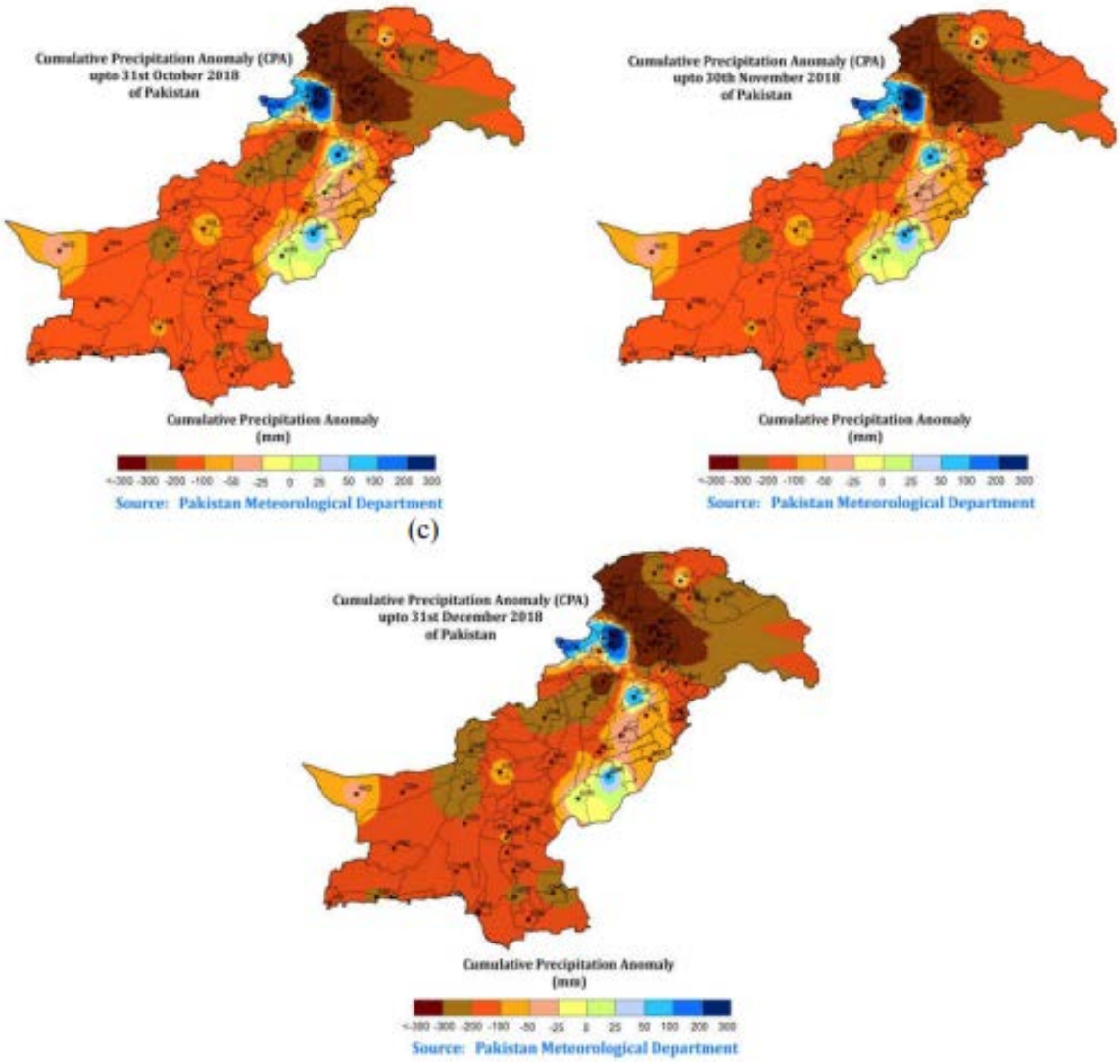


**Figure 21.** Cumulative precipitation anomaly in Pakistan from October to December 2018. Source: National Drought Monitoring Centre, Pakistan Meteorological Department

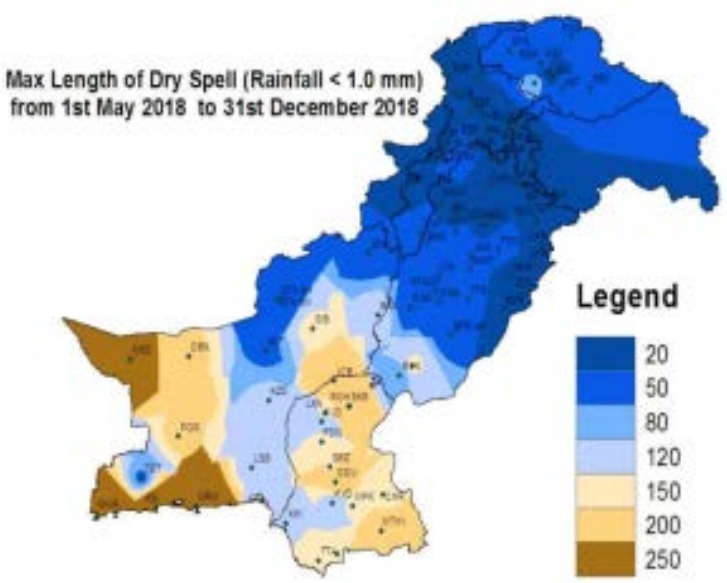


**Figure 22.** Maximum length of dry spell in Pakistan from October to December 2018. Source: National Drought Monitoring Centre, Pakistan Meteorological Department

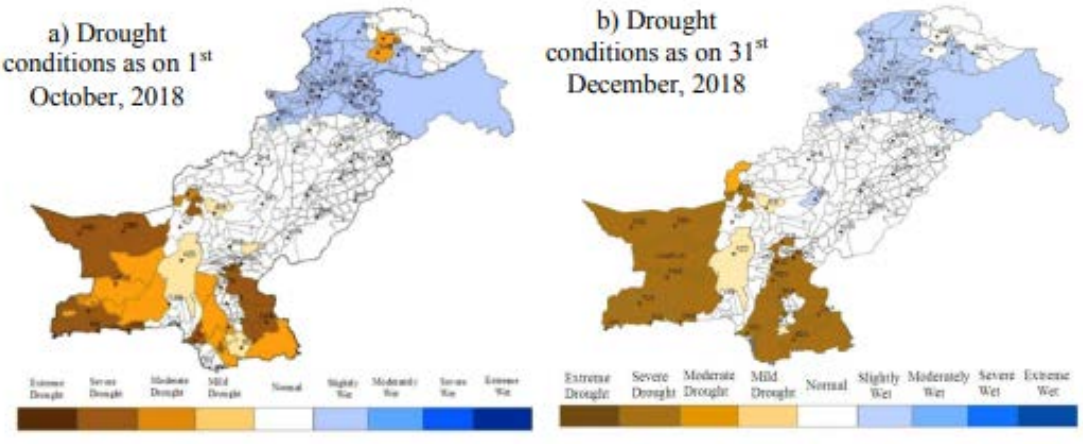


**Figure 23.** Drought conditions of Pakistan for October 2018 and December 2018. Source: National Drought Monitoring Centre, Pakistan Meteorological Department

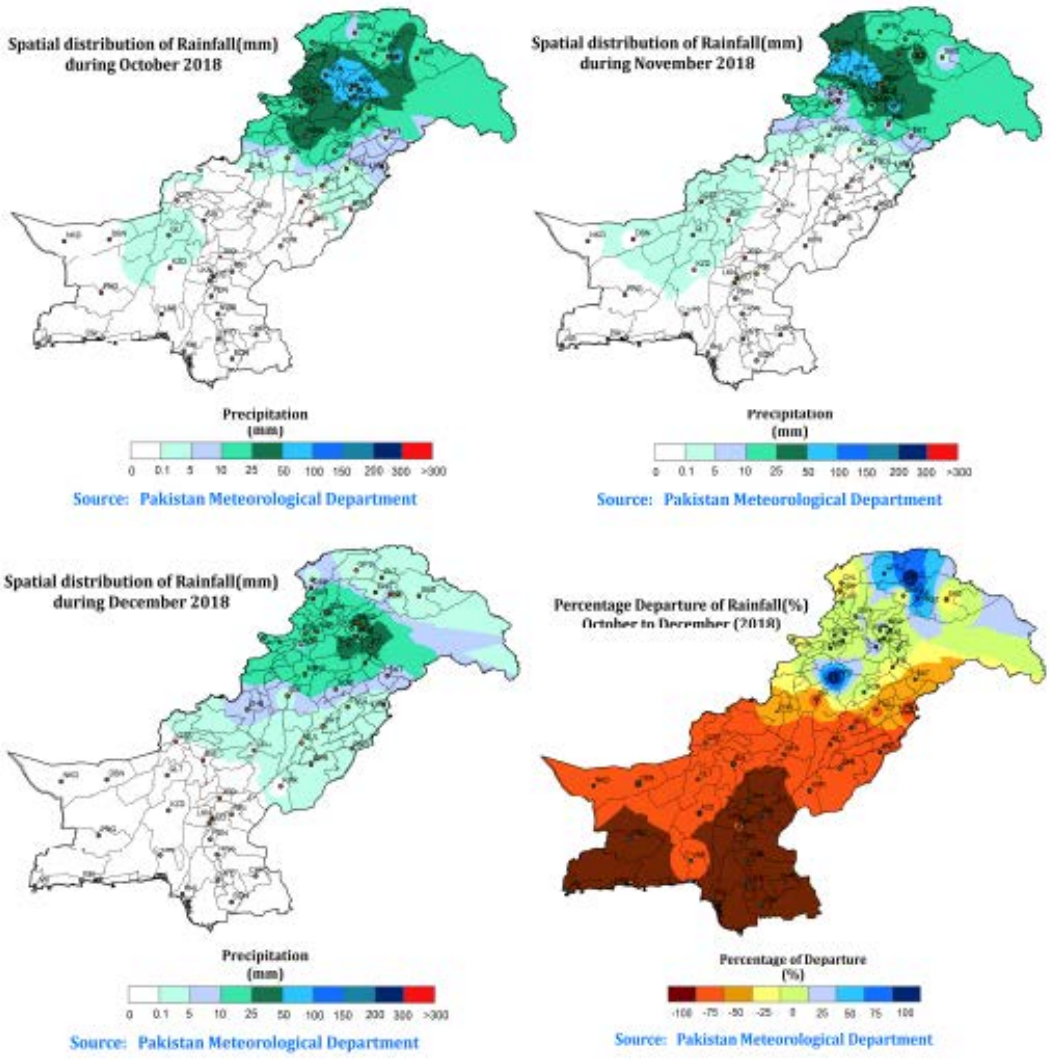


**Figure 24.** Spatial distribution of rainfall in Pakistan from October to December 2018. Source: National Drought Monitoring Centre, Pakistan Meteorological Department

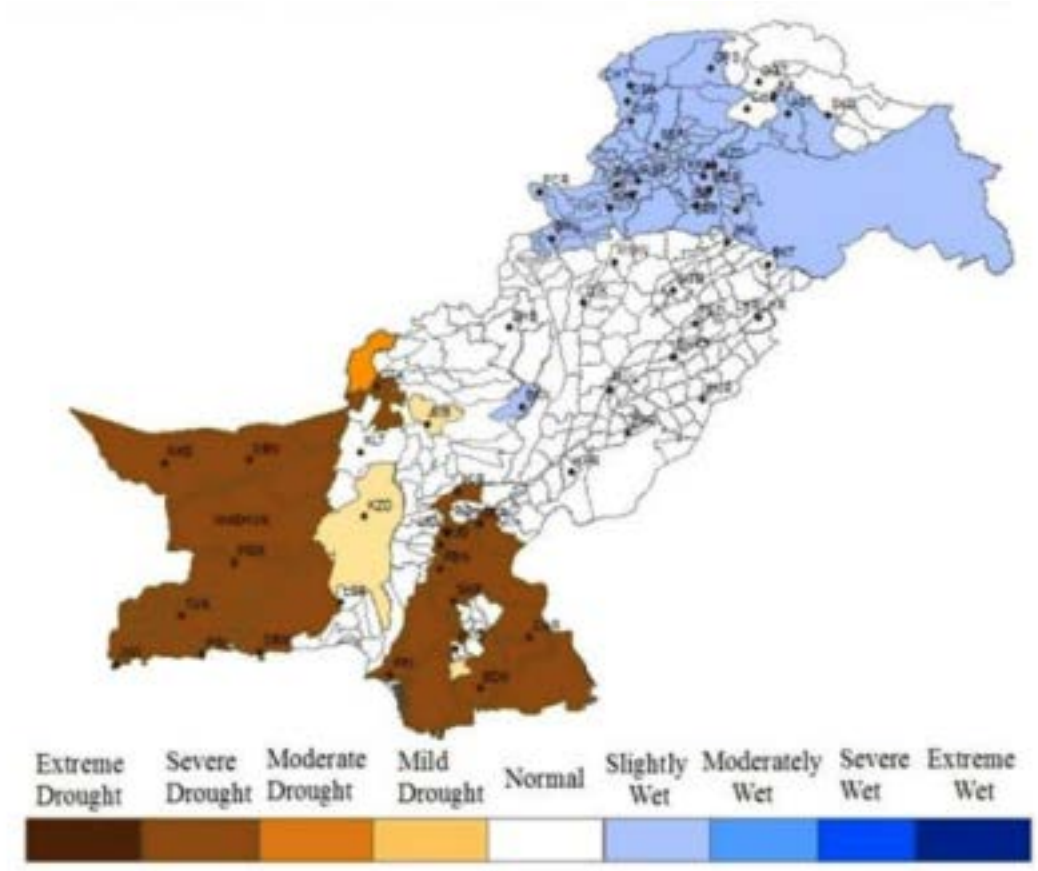


**Figure 25.** Drought conditions of Pakistan during first fortnight of January 2019. Source: National Drought Monitoring Centre, Pakistan Meteorological Department

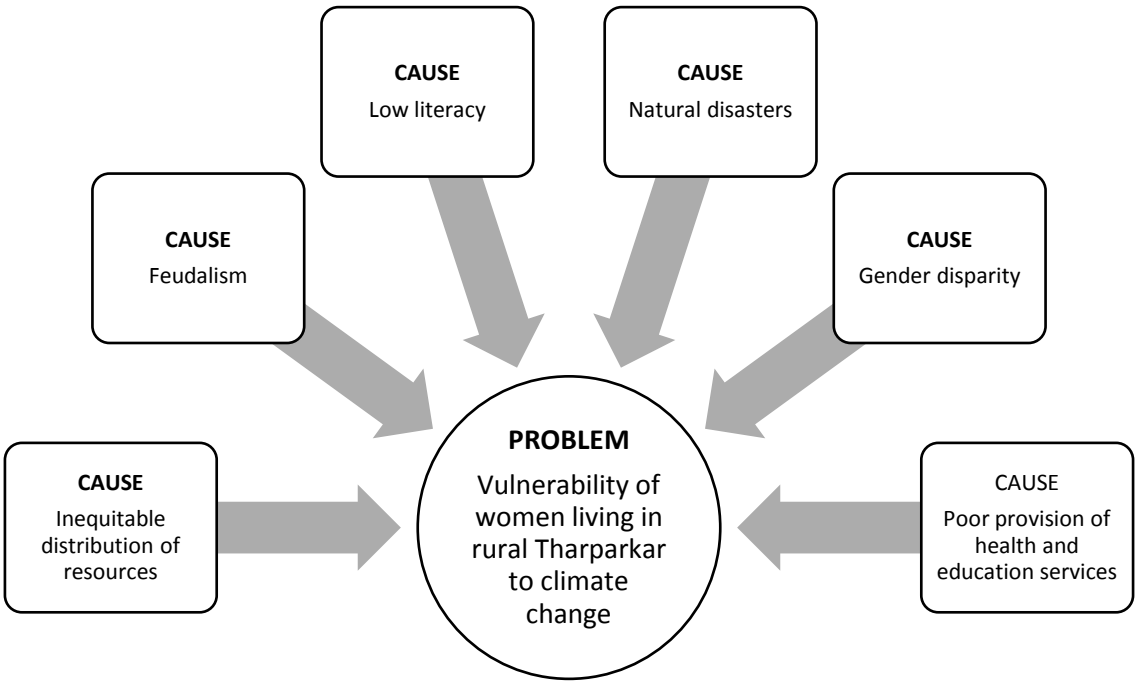


**FIGURE 26.** Social, economic, and environmental conditions that make women vulnerable to climate change and its effects in Tharparkar District, Sindh Province, Pakistan.

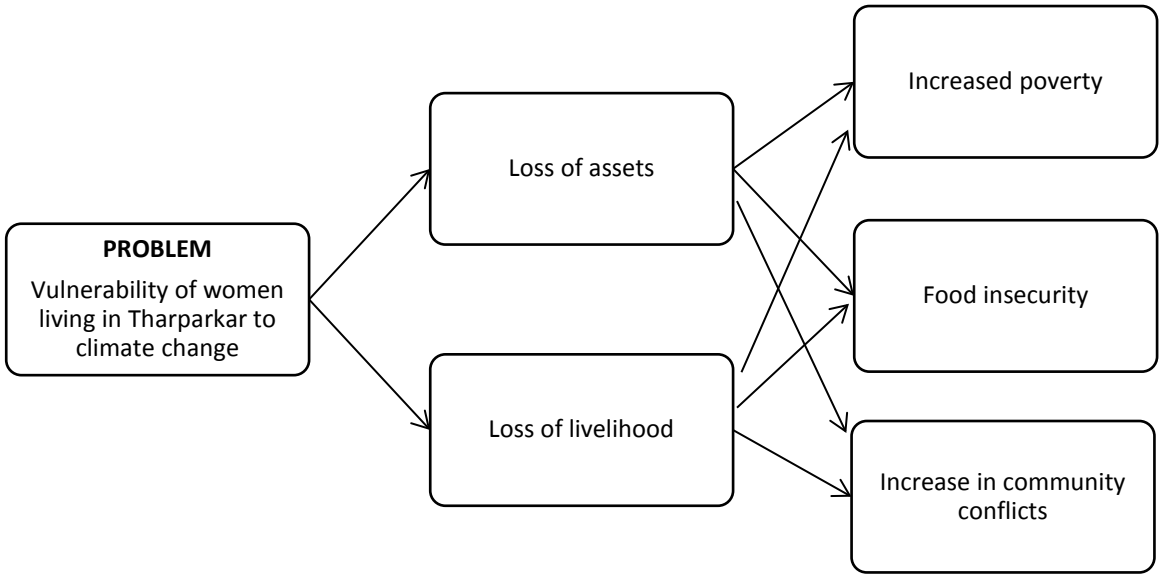


**FIGURE 27.** Factors that increase a woman's vulnerability to climate change and its effects in the wake of a natural disaster in Tharparkar District, Sindh Province, Pakistan.

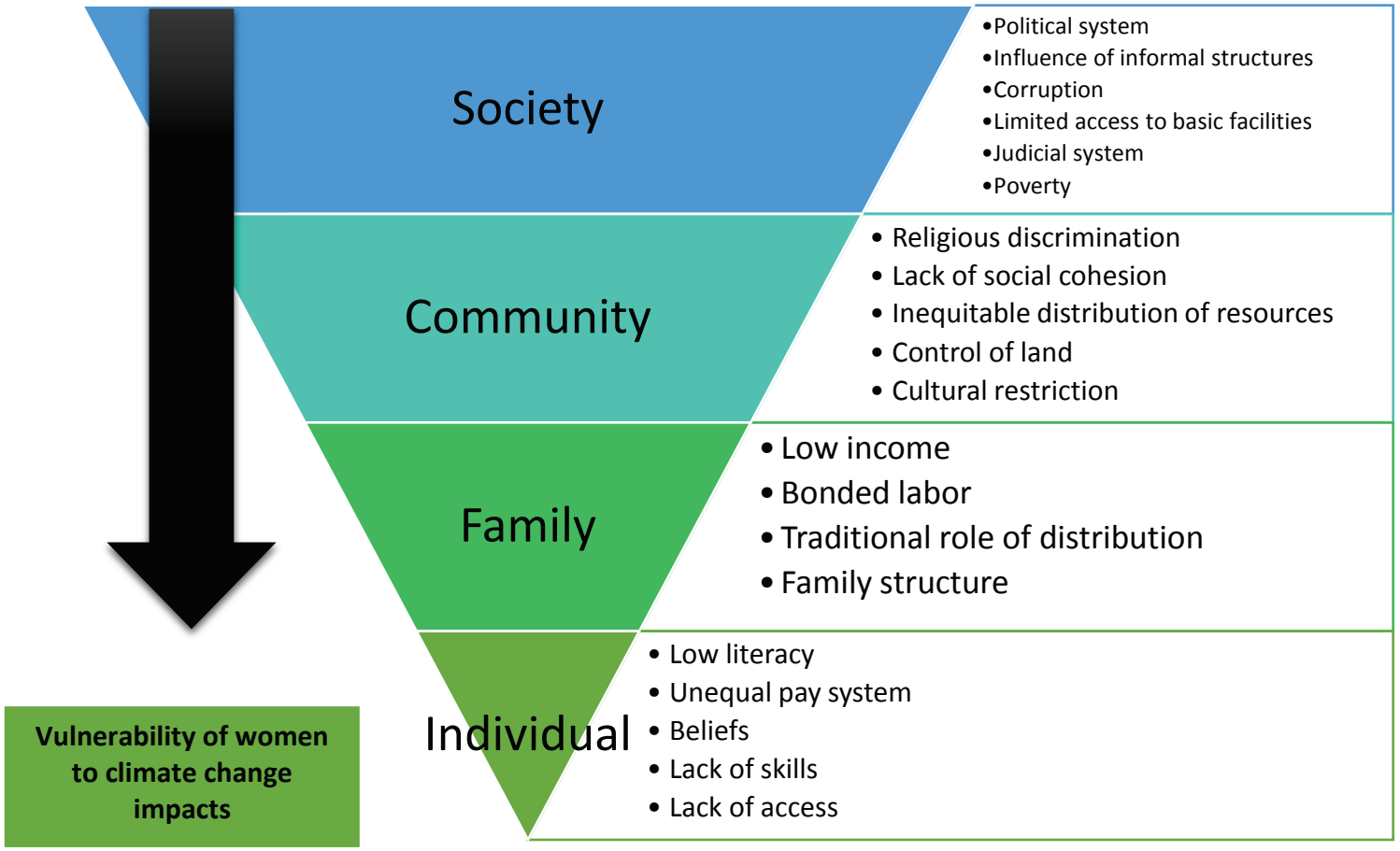


**FIGURE 28.** Compounding social and economic conditions that make women vulnerable to the impacts of climate change in Tharparkar District, Sindh Province, Pakistan.

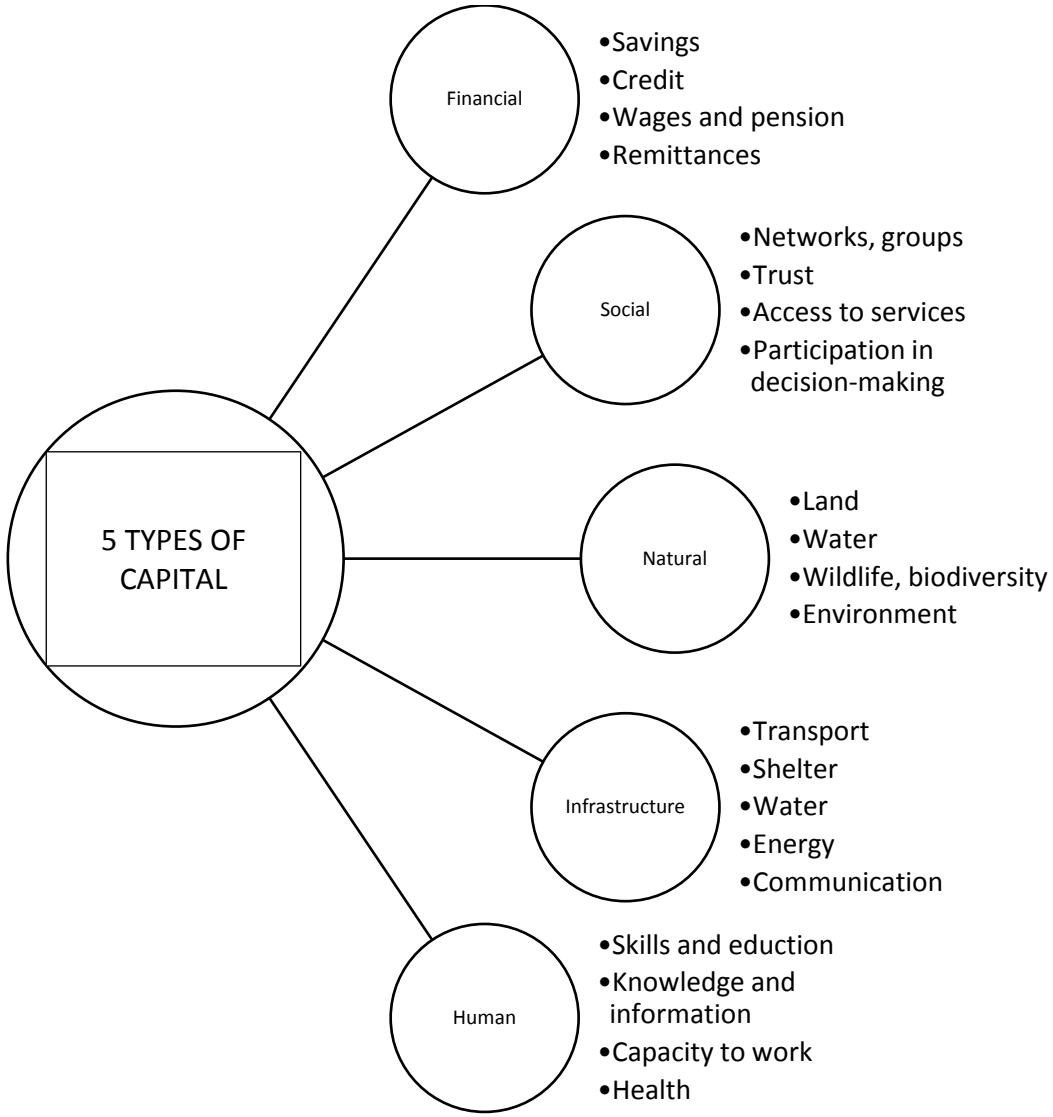


**FIGURE 29.** Types of capital potentially available to women to mitigate the impacts of climate change.

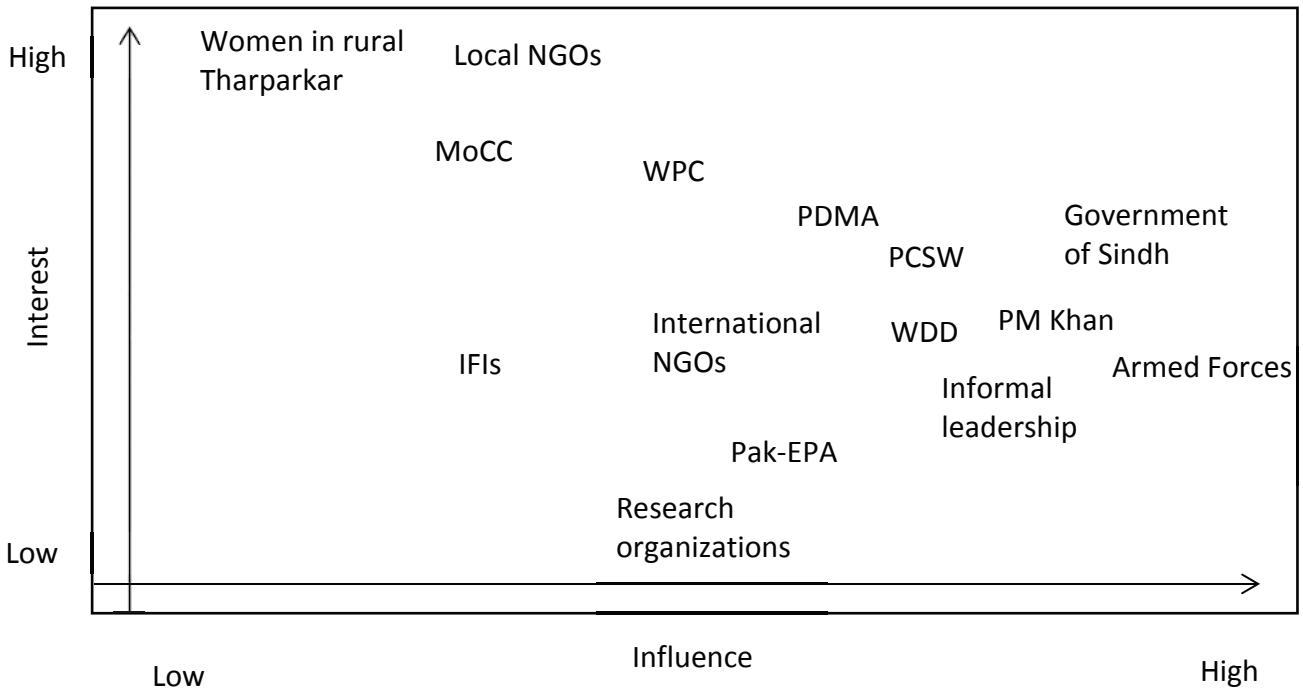


**FIGURE 30.** Stakeholder interest-Influence matrix.

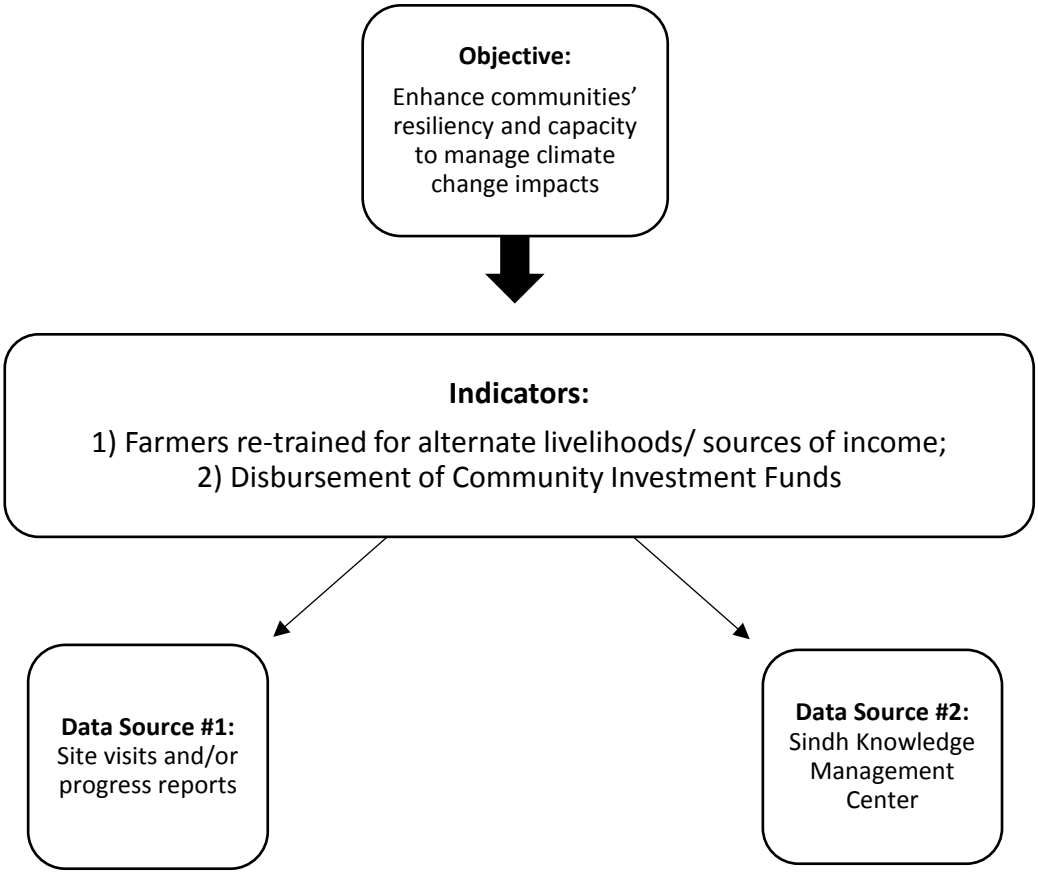


**Figure 31.** Example criteria for evaluation and monitoring to ensure transparency and implementation of policy objectives.

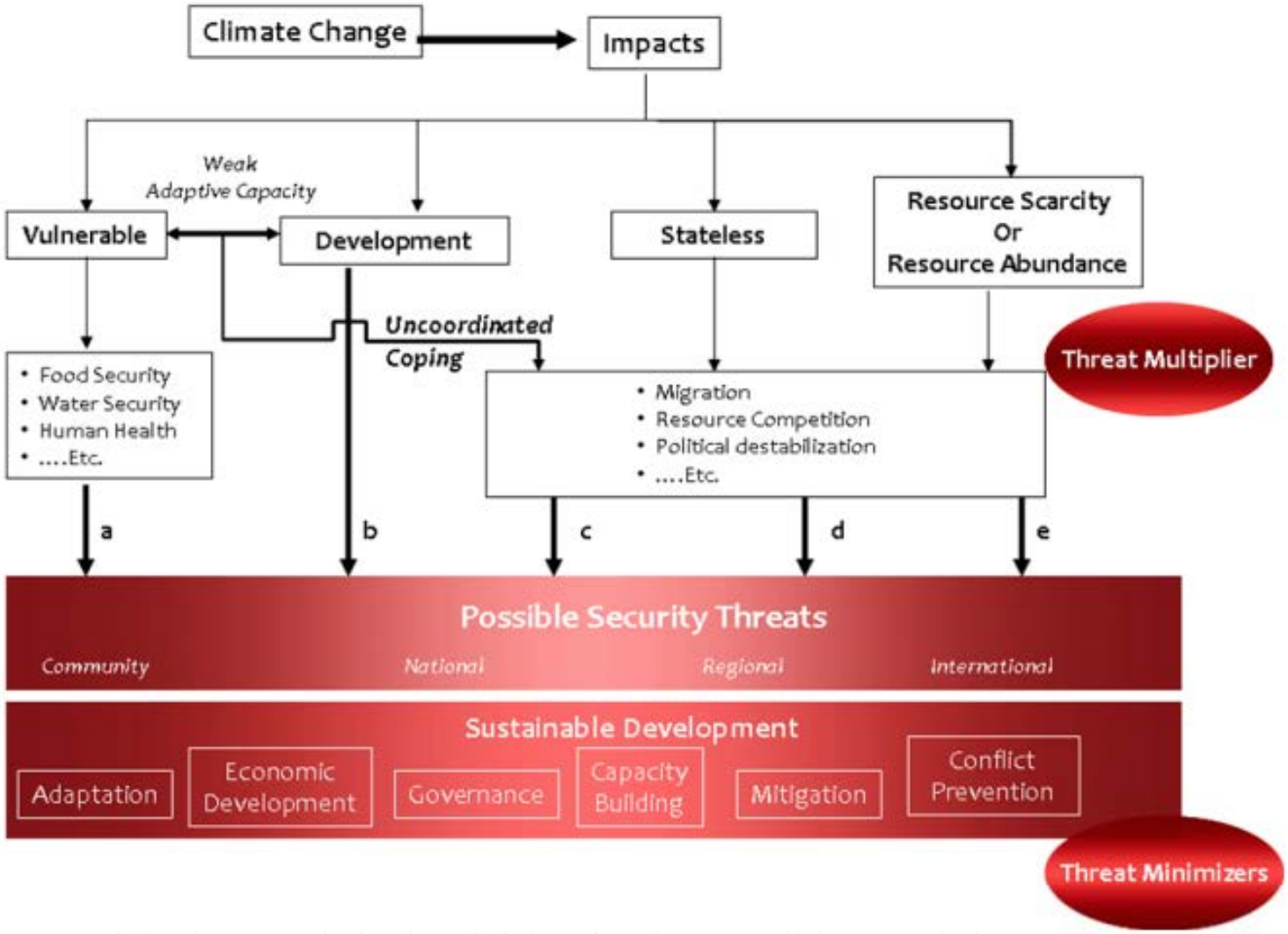


**FIGURE 32.** Five channels through which climate change can exacerbate existing sources of conflict and insecurity (labelled "threat multiplier") and the conditions, policies, institutions, or actions that relieve and manage stresses ("threat minimizers").
Source: United Nations Secretariat

**REFERENCES**


Abubakar Muhammad, S. 2016. *Women and Climate Change*. The International News. https://www.thenews.com.pk/print/116402-Women-and-climate-change

ACAPS. 2017. *Pakistan: Drought in Sindh Province.* https://www.acaps.org/special-report/pakistan-drought-sindh-province

ACT Alliance. 2018. *ALERTS – Drought Pakistan*. https://reliefweb.int/sites/reliefweb.int/files/resources/Alerts-Dougths-Pakistan-.pdf

Adnan, Shahzada & Ullah, Kalim & Shouting, Gao. (2015). *Characterization of Drought and Its Assessment over Sindh, Pakistan During 1951–2010.* J. Meteor. Res. 29. 837-857. DOI:10.1007/s13351-015-4113-z.

Aftab, Noor. 2018. *Seven lady doctors transferred to Tharparkar.* The News International. https://www.thenews.com.pk/print/294164-seven-lady-doctors-transferred-to-tharparkar

Aguayo, VM, Badgayan, N, Qadir, SS, Bugti, AN, Alam, MM, Nishtar, N, and Galvin, M. 2018. *Community management of acute malnutrition (CMAM) programme in Pakistan effectively treats children with uncomplicated severe wasting.* Matern Child Nutry. 14 Suppl 4:e12623. https://www.ncbi.nlm.nih.gov/pubmed/30499254

Ahmed, N. Mirza &. Schmitz, M. 2011. *Economic Assessment of the Impact of Climate Change on the Agriculture of Pakistan*. Business and Economic Horizons. 1-12.

Ahsan, S, Mansoori, N, Mohiuddin, SM, Mubeen, SM, Saleem, R, and Irfanullah, M. 2017. *Frequency and determinants of malnutrition in children aged between 6 to 59 months in District Tharparkar, a rural area of Sindh.* J Pak Med Assoc, 67(9): 1369-1373. https://www.ncbi.nlm.nih.gov/pubmed/28924276

Alam, M., Bhatia, R. &. Mawby, B. 2015. *Women and Climate Change*. Impact and Agency in Human Rights, Security, and Economic Development, Georgetown Institute for Women, Peace and Security.

Ali, Sajjad; Liu, Ying; Ishaq, Muhammad; Shah, Tariq; Abdullah; Ilyas, Aasir, & Ud Din, Izhar. *Climate Change and Its Impact on the Yield of Major Food Crops: Evidence from Pakistan*. Foods. 2017. 6(6), 39 https://doi.org/10.3390/foods6060039

Ali, Manzoor, Rafiq, Nazia, and Chandio, Abdu Rahim. 2018. *Descriptive Analysis of Social Factors Towards Child Health-Related Problems: A case study of Tharparkar District, Sindh, Pakistan.* International Journal of Scientific & Engineering Research. Vol. 9, Issue 12. https://www.researchgate.net/publication/329876920_A_DESCRIPTIVE_ANALYSIS_OF_SOCIAL_FACTORS_TOWARDS_CHILD_HEALTH-RELATED_PROBLEMS_A_CASE_STUDY_OF_THARPARKAR_DISTRICT_SINDH_PAKISTAN

Alif Ailaan. 2017. *Pakistan District Education Ranking 2017.* https://elections.alifailaan.pk/wp-includes/file/DER17.pdf

Alston, Margaret, and Kerri Whittenbury. *Research, Action and Policy: Addressing the Gendered Impacts of Climate Change.* Dordrecht: Springer Netherlands, 2013.

Alston, Margaret. 2014. *Gender Mainstreaming and Climate Change*. Women's Studies International Forum 47. 287-294

Amnesty International. 2002. *Pakistan Insufficient Protection of Women*. https://www.amnesty.org/download/Documents/116000/asa330062002en.pdf

Annual Status of Education Report (ASER) Pakistan. 2012. http://aserpakistan.org/document/aser/2012/reports/national/National2012.pdf

Anwar, T., Qureshi K, S., Ali, H. &. Ahmad. M. 2005. *Landlessness and Rural Poverty in Pakistan*. The Pakistan Development Review, Vol. 43, No. 4, Papers and Proceedings Part II, Twentieth Annual General Meeting and Conference of the Pakistan Society of Development Economists Islamabad, pp. 855-874.

Asian Specialised Meteorological Centre. 2019. *Seasonal Outlook*. http://asmc.asean.org/asmc-el-nino/

Asian Development Bank. 2000. *Country Briefing Paper: Women in Pakistan*. https://www.adb.org/sites/default/files/institutional-document/32562/women-pakistan.pdf

Asian Development Bank. 2012. *Addressing Climate Change and Migration in Asia and the Pacific*. Mandaluyong City

Asian Development Bank. 2015. *Gender Analysis (Summary)*, Country Partnership Strategy: Pakistan, 2015-2019. https://www.adb.org/sites/default/files/linked-documents/cps-pak2015-2019-ga.pdf

Asian Development Bank, 2016. *Country Gender Analysis – Pakistan*. Volume 1 of 2: Overall Gender Analysis. https://www.adb.org/sites/default/files/institutional-document/218821/pak-gender-assessment-vol1.pdf

Asian Development Bank. 2017. *Climate Change Profile of Pakistan.* https://www.adb.org/sites/default/files/publication/357876/climate-change-profile-pakistan.pdf

Asim, Muhammad &. Hanif, Shahina. 2012. *Climate Change and Women: A study in selected sites in Rural Sindh*. Pakistan, Shirkat Gah, Women's Resource Center.

*Assessment of Undiscovered Oil and Gas Resources In the Lower Indus Basin, Pakistan, 2017.*[Reston, Virginia]: U.S. Department of the Interior, U.S. Geological Survey, 2017.

Association of Physicians of Pakistani Descent of North America. 2019. *Thar Water Wells.* https://appna.org/thar-water-wells/

Association for Water, Applied Education & Renewable Energy. http://www.aware.org.pk/

Atapattu, Sumudu. *Human Rights Approaches to Climate Change: Challenges and Opportunities.* London: Taylor & Francis Group, 2015.

Aurat Foundation. 2011. *Women's Empowerment in Pakistan: A Scoping Study*.

Awal, M. 2013. *Social Safety Net, Disaster Risk Management and Climate Change Adaptation: Examining their Integration Potential in Bangladesh*. International Journal of Sociology, Study Vol. 1 Iss, 62-72.

Babaci-Wilhite, Zehlia. *Human Rights In Language and Stem Education : Science, Technology, Engineering and Mathematics.* Dordrecht: Sense Publishers, 2016.

Baden, Sally, Green, Cahty, Goetz, Anne Marie and Guhathakurta, Meghna. 1994. *Background report on gender issues in Bangladesh.* BRIDGE. Institute of Development Studies. Prepared for the British High Commission – Dhaka. Report No. 26. http://www.bridge.ids.ac.uk/sites/bridge.ids.ac.uk/files/reports/re26c.pdf

Barrera-Osorio, Felipe, et al. *Delivering Education to the Underserved Through a Public-private Partnership Program In Pakistan.* Washington, D.C.: The World Bank, 2017.

Bharti, Vishav. 2019. *Farm suicides unabated in Punjab, over 900 in 2 years.* The Tribune India. https://www.tribuneindia.com/news/punjab/farm-suicides-unabated-in-punjab-over-900-in-2-years/727671.html

Brahman, TG, Afridi, HI, Arain, SS, Kazi, AG, Talpu, FN, Baig, JA, Panhwar, AH, Arain MW, Ali, J, Arain, MB, and Naeemullah. 2016. *Toxic Risk Assessment of Arsenic in Males Through Drinking Water in Tharparkar Region of Sindh, Pakistan.* Biol Trace Elem Res. 172(1): 61-71. https://www.ncbi.nlm.nih.gov/pubmed/26606915

Brohi, N. 2010. *Gender and Land Reforms in Pakistan*, Sustainable Development Policy Institute.

Brohi, A.A &. Kakepoto, H. 2013. *Gender Differential Treatment in Social Development: A Sociological Study in Rural Sindh*. New Horizons 7.2.

Burke, Marshall, Hsiang, Sol, and Miguel, Ted. 2015. *Economic Impact of Climate Change on the World.* Nature. https://web.stanford.edu/~mburke/climate/map.php

Cannon, Terry. 2002. *Gender and Climate Hazards in Bangladesh.* Gender and Development. Vol. 10, No. 2, Climate Change, pp. 45-50. https://www.jstor.org/stable/4030573?seq=1#page_scan_tab_contents

CCC, 2009. *Climate Change, Gender and Vulnerable Groups in Bangladesh*. Climate Change Cell, DoE, MoEF; Component 4b, CDMP, MoFDM. Month 2009, Dhaka. https://core.ac.uk/download/pdf/48024281.pdf

Census of India. 2011 Census Data. Office of the Registrar General & Census Commissioner, India. Ministry of Home Affairs, Government of India. http://censusindia.gov.in/2011-Common/CensusData2011.html

Central Intelligence Agency (CIA). World Factbook. Pakistan. 2019. https://www.cia.gov/library/publications/the-world-factbook/geos/pk.html

Chen, Martha Alter. *Membership-based Organizations of the Poor.* London: Routledge, 2007.

*Climate change and its possible security implications*. Report of the Secretary-General. United Nations General Assembly. 11 September 2009. https://www.securitycouncilreport.org/atf/cf/%7B65BFCF9B-6D27-4E9C-8CD3-CF6E4FF96FF9%7D/sg%20report%202009.pdf

Climate Change Knowledge Portal: Pakistan. World Bank Group. https://climateknowledgeportal.worldbank.org/country/pakistan

Climate Emergency Institute. 2017. *Global Warming and its Impacts on Pakistan*. https://www.climateemergencyinstitute.com/uploads/global_warming_and_its_impacts_on_Pakistan.pdf

Consortium Management Unit. 2014. *Drought Assessment Report*. Districts Tharparkar and Umerkot. 26th October - 1st November 2014. https://www.humanitarianresponse.info/en/operations/pakistan/assessment/drought-assessment-report-districts-tharparkar-and-umerkot-26th

Das, Anindya. 2009. *Farmers' Suicide in India: Implications for Public Mental Health.* International Journal for Social Psychiatry. Vol. 57, 1, pp. 21-29. https://journals.sagepub.com/doi/10.1177/0020764009103645

Cresweel, Randy and Martin, Franklin W. Dryland Farming: Crops & Techniques for arid Regions. Revised 1998. ECHO. http://cropsfordrylands.com/wp-content/uploads/Dryland-Farming-Crops-Tech-for-Arid-Regions.pdf

*Daily Emergency and Response Situational Information Report.* 29 December 2014. US AID. iMMAP. https://reliefweb.int/sites/reliefweb.int/files/resources/Daily%20Emergency%20and%20Response-Situational%20Information%20Report%2029th%20December%202014.pdf

Dankelman, I. 2010. *Gender and Climate Change: An Introduction*. Earthscan, Washington, D.C.

Daoud, Mona. *Using Fieldwork to Explore the Linkages Between Gendered Livelihoods and Adaptation to Climate Change: Insights and Challenges.* London: SAGE Publications, 2016.

Daudani, S.A. 2009. *Socio-economic and Demographic Characteristics of Illiterate Women in Rural Sindh*. Indus Valley Education.

Di Nunzio, Jack. 2014. *Malnutrition and Chronic Water Scarcity Persist in Pakistan's South-East.* Future Directions International. http://www.futuredirections.org.au/publication/malnutrition-and-chronic-water-scarcity-persist-in-pakistan-s-south-east/

District map of Sindh Province. Government of Sindh. https://sindh.gov.pk/

*Drought Bulletin of Pakistan: April-June 2014*. National Drought Monitoring Centre. Pakistan Meteorological Department. http://www.ndmc.pmd.gov.pk/quater214.pdf

*Drought Bulletin of Pakistan: July-September 2014*. National Drought Monitoring Centre. Pakistan Meteorological Department. http://www.ndmc.pmd.gov.pk/quater314.pdf

*Drought Bulletin of Pakistan: October-December 2018*. National Drought Monitoring Centre. Pakistan Meteorological Department. http://www.ndmc.pmd.gov.pk/quater418.pdf

Ebrahim, Z. 2010. *Rights-Pakistan: Slowly, Women Gain Ground through Land Ownership*. Inter Press Service News Agency. http://www.ipsnews.net/2010/07/rights-pakistan-slowly-women-gain-ground-through-land-ownership/

Ebrahim, Zofeen T., 2014. *Migration seen through the prism of climate change*. Dawn. https://www.dawn.com/%20news/1129428/migration-seen-through-the-prism-of-climate-change

Ebrahim, Zofeen T. 2018. *Does the environment matter in Pakistan's elections?* Dawn. https://www.dawn.com/news/1419200

Ensor, Jonathan, and Rachel Berger. *Understanding Climate Change Adaptation: Lessons From Community-based Approaches.* Warwickshire, UK: Practical Action Publishing, 2009.

FAO. 2011. *The State of Food and Agriculture 2010–2011: Women in Agriculture*. Closing the Gender Gap for Development, Rome: Food and Agriculture Organization.

FAO. 2013. *Governing Land for Men and Women: A Technical Guide to Support the Achievement of Responsible Gender-Equitable Governance of Land Tenure*. Rome: Food and Agriculture Organization of the United Nations.

FAO. 2015. *Women in Agriculture in Pakistan*. http://www.fao.org/3/a-i4330e.pdf

FAO & Pakistan Food Security Cluster, 2017. *Integrating Nutrition into Food Security and Livelihoods Interventions for Emergencies.* Guidelines. https://fscluster.org/sites/default/files/documents/guidelines-integrating_nutrition_into_food_security.pdf

FAO, 2018. *The impact of disasters and crises on agriculture and food security. 2017.* http://www.fao.org/3/I8656EN/i8656en.pdf

FAO. 2019. *Global Information and Early Warning System. Pakistan.* Country Briefs. http://www.fao.org/giews/countrybrief/country.jsp?code=PAK

Fast Rural Development Program. 2018. *Drought in District Tharparkar.* Rapid Need Assessment Report. October 2018. https://reliefweb.int/sites/reliefweb.int/files/resources/tharparkar_assessment_2018-frdp-acf-21oct18.pdf

Fletcher, Amber J, and Wendee Kubik. *Women In Agriculture Worldwide : Key Issues and Practical Approaches.* Milton, Abingdon: Taylor and Francis, 2016.

Food and Security Cluster, Pakistan. 2016. *Sindh Drought Needs Assessment: The State of Agriculture, Livelihood, Food Security, Nutrition, Water and Sanitation in Drought Affected Communities in Sindh*. Provincial Disaster Management Authority (PDMA) & FAO.

García, Brígida. *Women, Poverty, and Demographic Change.* Oxford [England]: Oxford University Press, 2000.

Ghani, Faras. 2016. *Tharparkar: Pakistan's ongoing catastrophe.* Al Jazeera. https://www.aljazeera.com/indepth/features/2016/06/tharparkar-pakistans-ongoing-catastrophe-160629111410198.html

August, Kristin J and Rook, Karen S. *Social Relationships.* Encyclopedia of Behavioral Medicine. 2013 edition. https://link.springer.com/referenceworkentry/10.1007%2F978-1-4419-1005-9_59

Global Climate Risk Index 2018. Germanwatch. https://germanwatch.org/en/node/14987

Global Climate Change Impact Studies Center. Islamabad, Pakistan. http://www.gcisc.org.pk/

Ghuman, R.S. 2012. *The Sikh Community in Indian Punjab: Some socio-economic challenges*. International Journal of Punjab Studies. 19(1):87-109. https://www.researchgate.net/publication/285526745_The_Sikh_community_in_Indian_Punjab_Some_socio-economic_challenges

Government of the Peoples' Republic of Bangladesh. 2008. *National Plan for Disaster Management 2008-2015.* Disaster Management Bureau. Ministry of Food and Disaster Management. https://www.preventionweb.net/files/9472_NationalPlanforDisastermanagement.pdf

Government of Sindh. 2017. *Sindh: At a glance 2017*. Bureau of Statistic. Planning & Development Department. http://sindhbos.gov.pk/wp-content/uploads/2018/05/SAG-2017-1.pdf

Guriro, Amar. 2016. *Pakistan's coal expansion brings misery to villagers in Thar desert.* The thirdpole.net. https://www.thethirdpole.net/en/2016/08/23/pakistans-coal-expansion-brings-misery-to-villagers-in-thar-desert/

Haddad, Yvonne Yazbeck, and John L Esposito. *Islam, Gender, & Social Change.* New York: Oxford University Press, 1998.

Hamid, A. Yara. &. Afzal, J. 2013. *Gender, Water and Climate Change: The Case of Pakistan*. Pakistan Water Partnership Policy Paper Series. https://www.scribd.com/document/252092100/Gender-Water-and-Climate-Change-The-Case-of-Pakistan-pdf

HANDS Pakistan. 2014. 1st Situation Analysis Survey Report, District Tharparkar. March 2014. https://reliefweb.int/report/pakistan/1st-situation-analysis-survey-tharparkar-march-2014

Hanif, Mohammad & Ramey, Muhammad Aleem UI Hassan. *Climate Change Scenarios in Pakistan: A Case Study of Thar, Sindh.* 2014. Research & Development Foundation. Kindernothlife (KNH). German Federal Ministry for Economic Cooperation & Development. https://www.preventionweb.net/files/41642_41642climatechangescenariosacasestu.pdf

Hasan, Arif. *The Unplanned Revolution: Observations On the Process of Socio Economic Changes In Pakistan.* Rev. ed Karachi: Oxford University Press, 2009.

Hashim, Asad. 2014. *Pakistan's Thar residents living on the edge*. https://www.aljazeera.com/indepth/features/2014/03/pakistan-thar-residents-living-edge-20143151211209041 02.html

Hashim, Asad. 2016. *Pakistan bans airing of 'undesired' contraceptive advertisements.* Reuters. https://www.reuters.com/article/us-pakistan-contraception-ban-idUSKCN0YJ0BT

Hasnain, T. 2012. *Vulnerability of Rural Women to Environmental Issues*. Envirocivil. https://envirocivil.com/environment/vulnerability-of-rural-women-to-environmental-issues/

Hassan, M. 2016. *Inequality: Missing from the Public Agenda*. Development Advocate, Pakistan. Vol.3, Issue.2. UNDP. https://www.undp.org/content/dam/pakistan/docs/DevelopmentPolicy/DAP%20June%202016%20-%20English.pdf

Hassan, Syed Raza. 2017. *In Pakistan's coal rush, some women drivers break cultural barriers.* Reuters. https://www.reuters.com/article/us-pakistan-women-drivers/in-pakistans-coal-rush-some-women-drivers-break-cultural-barriers-idUSKCN1C41PL

Herani, Gobind, Rajar, Allah Wasayo and Khaskheli, Muhammad Ali. 2007. *Reforming farmland and rangeland in Tharparkar: Suggested implementations for income generation.* Indus Journal of Management & Social Sciences, Vol. 1 pp 16-36. https://mpra.ub.uni-muenchen.de/5542/

International Food Policy Research Institute. 2012. *Increase in agricultural research spending in Pakistan is needed.* http://www.ifpri.org/news-release/increase-agricultural-research-spending-pakistan-needed?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%253A+Ifpriupdate+%2528IFPRI+Website+Update%2529

Ijaz, Zainab. 2012. *Impact of Female Literacy Rate and Health Facilities on Infant Mortality Rate in Pakistan*. International Journal of Humanities and Social Science. Vol. 2 No. 12. http://www.ijhssnet.com/journals/Vol_2_No_13_July_2012/13.pdf

Imran, Myra. 2016. *Only 5.8% judges in Pakistan are women: HRCP*. The News International. https://www.thenews.com.pk/print/102929-Only-58-judges-in-Pakistan-are-women-HRCP

International Center for Integrated Mountain Development (ICIMD). 2008. *Case Study: Gender and Climate Change in the Hindu Kush Himalayas of Nepal*. https://www.wedo.org/wp-content/uploads/nepalcasestudy.pdf

International Development Research Center. 2008. *Women and Land*: *Case Study Pakistan*. https://www.idrc.ca/sites/default/files/sp/Documents%20EN/Pakistan-in-focus-case-study-women.pdf

International Federation of Red Cross and Red Crescent Societies. *Emergency Plan of Action. Pakistan: Drought.* 21 February 2019. http://glidenumber.net/glide/public/search/details.jsp?glide=21478&record=1&last=97

International Labor Organization. 2017. *Gender and development.* https://www.ilo.org/global/topics/economic-and-social-development/gender-and-development/lang--en/index.htm

International Union for Conservation of Nature and Natural Resources (IUCN) Pakistan, Sindh Program. 2007. *Sindh Strategy for Sustainable Development*. https://portals.iucn.org/library/node/9206

International Union for Conservation of Nature (IUCN). 2011. *Climate Change and Gender in Bangladesh*. Information Brief. https://www.iucn.org/content/bangladesh-climate-change-and-gender-action-plan

International Union for Conservation of Nature and Natural Resources. 2012. *Nepal: Climate Change and Gender Action Plan*. http://genderandenvironment.org/resource/nepal-climate-change-gender-action-plan-ccgap-report/

International Union for Conservation of Nature – Pakistan. 2019. *Sindh's Climate Migration Report Launched at Policy Dialogue.* https://www.iucn.org/news/pakistan/201901/sindhs-climate-migration-report-launched-policy-dialogue

Jain, Mehak. 2018. *Punjab Agricultural University reaches out to farmers in distress.* The Times of India. https://timesofindia.indiatimes.com/city/ludhiana/pau-reaches-out-to-farmers-in-distress/articleshow/65745545.cms

Jaggarta Social Welfare Organization (JSWO). 2014. *Tharparkar Drought 2014*. https://reliefweb.int/sites/reliefweb.int/files/resources/Tharparkar%20Drought%202014.pdf

Jaffrelot, Christophe. *The Pakistan Paradox: Instability and Resilience.* New York, NY: Oxford University Press, 2015.

Jamal, H. &. Lohano Ram, H. 2008. *Understanding Rural Poverty Dynamics: The Case of the Poorest District of Sindh in Pakistan*. Social Policy and Development Center, Research Report No. 78.

Jeffery, Roger, and Alaka Malwade Basu. *Girls' Schooling, Women's Autonomy, and Fertility Change In South Asia.* New Delhi: Sage Publications in association with the Book Review Literary Trust, New Delhi, 1996.

Katha Kartiki. 2011. *Climate Change and Migration: A Case Study from Rural Bangladesh*. Gender & Development, 19:1, 23-38.

Kaur, Sandeep. 2010. *Issue of Women's Empowerment in Punjab: A critique.* The Indian Journal of Political Science. Vol. 71, No. 1, pp. 333-344. https://www.jstor.org/stable/42748391

Khan, Jahan Dad. *Pakistan Leadership Challenges.* Oxford: Oxford University Press, 1999.
Khan, Mahmood Hasan. *Participatory Rural Development In Pakistan: Experience of Rural Support Programmes.* Oxford: Oxford University Press, 2009.

Khan Ali, M., Pandey, N. &. Vivekananda, J. 2013. *Strengthening Responses to Climate Variability in South Asia, Discussion Paper: Sindh*. International Alert.

Khan, A. Mohammad, Khan, A. Jawad, Ali, Z, Ahmad, I. & Ahmad, N. Muhammad. 2016. *The Challenge of Climate Change and Policy Response in Pakistan*. Environment Earth Science. 27:412.

Khan, Rina Saeed. 2018. *How Pakistan's 'tree tsunami' will revive their climate action*. World Economic Forum. https://www.weforum.org/agenda/2018/12/pakistan-bets-on-tree-tsunami-to-revive-climate-action/

Khangharani, Sono 2014. *Drought in Thar: some more broken promises*. http://www.dawn.com/news/1132994

Khattak, G.Saba, Brohi, N. & Anwar. W. 2010. *Women's Land Rights: Research Findings from Pakistan*. Sustainable Development Policy Institute.

Kolhi, Chander. 2014. *Drought and migration: A brief story of Tharparkar*. https://dailytimes.com.pk/105392/drought-and-migration-a-brief-story-of-tharparkar/

Kompas, Tom, Pham, Van Ha and Che, Tuong Nhu. 2018. *The Effects of Climate Change on GDP by Country and the Global Economic Gains from Complying With the Paris Climate Accord.* AGU. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018EF000922

Korson, J. Henry. *Contemporary Problems of Pakistan.* Boulder, CO: Westview Press, 1993.

Kumar, Love. 2017. *Thar Villages Fighting Fluoride Poisoning in Groundwater*. Natura, Vol. 41, Issue 3. World Wildlife Fund. http://www.wwfpak.org/natura42/tharvillages.php

Kumar, K Ram. 2018. *Rural co-op bank plans R100-crore fund to help women start business.* The Hindu Business Line. https://www.thehindubusinessline.com/money-and-banking/rural-coop-bank-plans-100crore-fund-to-help-women-start-business/article10017221.ece

*Land Cover Atlas of Pakistan: The Sindh Province*. 2014. http://www.fao.org.pk/pub/14/Sindh/Atlas-Sindh-web_69-72.pdf

Laplante, Benoît, et al. *Adaptation To Climate Extremes In Developing Countries: The Role of Education.* Washington, D.C.: The World Bank, 2010.

Lieven, Anatol. *Pakistan: a Hard Country.* [1st pbk. ed.]. New York: Public Affairs, 2012.

Mainlay, J. and Tan, S.F. 2012. *Mainstreaming Gender and Climate Change in Nepal*. IIED Climate Change Working Paper No. 2. https://pubs.iied.org/pdfs/10033IIED.pdf

Makhijani, B.H., Kumbhar, I.M., Mughal, S. & Talpur, U. 2015. *Women Entrepreneurship: Problems Faced by Rural Women Entrepreneurs in Sindh Province of Pakistan*. Journal of Basic and Applied Sciences, Vol.11, 274-277. http://www.lifescienceglobal.com/pms/index.php/jbas/article/view/2874

Malik Mariam, S., Awan, H. &. Khan, N., 2012. *Mapping Vulnerability to Climate Change and its Repercussions on Human Health in Pakistan*. Globalization and Health. https://globalizationandhealth.biomedcentral.com/articles/10.1186/1744-8603-8-31

Malik, A Sami., 2015. *UNICEF Reaching Children and Women in Thar Desert to Counter Malnutrition*. https://reliefweb.int/report/pakistan/unicef-reaching-children-and-women-thar-desert-counter-malnutrition

Mandal, Chandan Kumar. 2017. '*Average annual temp rose by 0.056 degree Celcius on the past 4 decades'.* The Kathmandu Post. http://kathmandupost.ekantipur.com/news/2017-08-27/average-annual-temp-rose-by-0056-degree-celcius-in-the-past-4-decades.html

Map of Pakistan. ©2018 Geology.com. https://geology.com/world/pakistan-satellite-image.shtml

Matthew A, R. &. Zaidi Ali, A.. 2002, *People, Scarcity and Violence in Pakistan*. International Union for Conservation of Nature. https://www.iisd.org/pdf/2002/envsec_conserving_1.pdf

McSweeney, C., New, M. and Lizcano, G. 2007. *Climate Change Country Profiles: Pakistan*. https://www.geog.ox.ac.uk/research/climate/projects/undp-cp/index.html?country=Pakistan&d1=Reports

Memon, N.I., Noonari, S., Kalroo, A.M., Memon, Z., Pathan, A., Manzoor, A. &. Pathan, M. 2010. *Women Labor Participation of Agricultural Production in Sindh*. Pakistan, Journal of Resources Development and Management, Vol.10.

Memon, Naveed. 2015. Annual Review, Sindh Rural Support Organization (SRSO). https://srso.org.pk/reports/a_rprt/SRSO%20Annual%20Report%202015-16.pdf

Ministry of Climate Change Pakistan. 2012. National Climate Change Policy. http://www.gcisc.org.pk/National_Climate_Change_Policy_2012.pdf

Moghadam, Valentine M. *Identity Politics and Women: Cultural Reassertions and Feminisms In International Perspective.* Boulder: Westview Press, 1994.

Momtaz, Salim, and Muhammad Asaduzzaman. *Climate Change Impacts and Women's Livelihood : Vulnerability In Developing Countries.* Milton: Routledge, 2018.

Moran, Daniel. *Climate Change and National Security: a Country-level Analysis.* Washington, D.C.: Georgetown University Press, 2011.

Mumtaz, Soofia, Jean-Luc Racine, and Imran Ali. *Pakistan:the Contours of State and Society* .Oxford: Oxford University Press, 2002.

Mustafa, Daanish. *Water Resource Management In a Vulnerable World : the Hydro-hazardscapes of Climate Change.* London: I.B. Tauris , 2013.

National Commission on Status of Women, Annual Report. 2014. http://www.ncsw.gov.pk/downloadpublication/59

National Commission of the Status of Women. http://www.ncsw.gov.pk/

National Commission on the Status of Women. 2015. http://www.ncsw.gov.pk/previewhighlights/91

National Disaster Management Authority. 2013. *National Disaster Reduction Policy*. http://www.ndma.gov.pk/plans/drrpolicy2013.pdf

National Disaster Management Authority (NDMA). 2019. *National Disaster Response Plan 2019*. https://app.adpc.net/publications/national-disaster-response-plan-2019-ndrp-2019

Nepal Climate Change Knowledge Management Center (NCCKMC). http://www.ncckmcnast.org.np/team-members

*Nepal Earthquake Studies: Caste-based inequality*. Dartmouth Journeys. https://journeys.dartmouth.edu/NepalQuake-CaseStudies/caste-based-inequality/

Nicholas, Simon and Buckley, Tim. 2018. *Pakistan's Power Future*. Institute for Energy Economics and Financial Analysis. http://ieefa.org/wp-content/uploads/2018/11/Pakistans-Power-Future_December-2018.pdf

Nazeer, Amjad, Khan, Asad, and Sharif, Azhar. 2018. *State of Education in District Badin and Tharparkar (Sindh).* SPO and IDRAC. https://www.academia.edu/35992682/State_of_Education_in_District_Badin_and_Tharparkar_Sindh_

Noshirwani, M. 2012. *Climate Change Adaptation: Political and Institutional Analysis, Sindh*. World Wide Fund for Nature – Pakistan. https://www.wwfpak.org/ccap/pdf/Political%20&%20Instituitonal%20Analysis.pdf

Noshirwani, M. 2016. *Climate Change and its Impact on Gender in Rural areas of Sindh, Pakistan*. International Union for Conservation of Nature. https://www.iucn.org/news/climate-change-and-its-impact-gender-rural-areas-sindhpakistan

*Nurture: Pakistan's Pioneer Publication On Early Childhood Development.* Karachi: Sindh Education Foundation, 2007. http://archives.sef.org.pk/images/publications/nurture/Nurture%20IV.pdf

Onta, Nisha; Resurreccion, Bernadette P. 2011. *The Role of Gender and Caste in Climate Adaptation Strategies in Nepal: Emerging Change and Persistent Inequalities in the Far Western Region*. Mountain Research and Development; 351-356. https://www.jstor.org/stable/mounresedeve.31.4.351?seq=1#metadata_info_tab_contents

Otzelberger, A. 2014. *Tackling the Double Injustice of Climate Change and Gender Inequality*. CARE Climate Change. http://www.careclimatechange.org/files/Double_Injustice.pdf

Oxfam. 2017. *Consolidated Gender Analysis for Disaster Response in Pakistan*. https://reliefweb.int/sites/reliefweb.int/files/resources/rr-consolidated-gender-analysis-pakistan-150317.pdf

*Pakistan, Satellite Image Map.* Reston, Va.: The Survey, 1997. https://pubs.usgs.gov/fs/fs109-97/

Pakistan Army. Government of Pakistan. Website. https://www.pakistanarmy.gov.pk/AWPReview/HomePage.html

Pakistan Bureau of Statistics. 1998. *Populations and Housing Census*. http://www.pbs.gov.pk/population-tables

Pakistan Bureau of Statistics. Population and Housing Census 2017. Provisional Results. http://www.pbs.gov.pk/content/population-census

*Pakistan Millennium Development Goals. Report 2013.* Ministry of Planning, Development and Reform. Government of Pakistan. https://www.undp.org/content/dam/pakistan/docs/MDGs/MDG2013Report/UNDP-Report13.pdf

*Pakistan elected VP, Rapporteur of UN COP*. The Express Tribune. 2018. https://tribune.com.pk/story/1868230/1-pakistan-bags-un-climate-change-bodys-vice-president-slot/

Pakistan Environmental Protection Agency (EPA). http://environment.gov.pk/

Pakistan Meteorological Department. 2012. *Climate Change in Pakistan: Focused on Sindh Province*. Technical Report No. PMD-25. https://www.researchgate.net/publication/270589207_Climate_Change_in_Pakistan_Focused_on_Sindh_Province

Parry, Jo-Ellen, Osman, Hisham and McCandless, Matthew. 2016. *The Vulnerability of Pakistan's Water Sector to the Impacts of Climate Change: Identification of gaps and recommendations for action*. International Institute for Sustainable Development. https://www.iisd.org/project/vulnerability-pakistan-water-sector-impacts-climate-change

National Drought Monitoring Centre. Pakistan Meteorological Department. Government of Pakistan. 2019. http://www.ndmc.pmd.gov.pk/quater318.pdf

Pakistan Nutrition Coordination Working Group. 2014. *Nutrition, Food Security and Livelihood Emergency Tharparkar District, Sindh Province, Pakistan.* Briefing Note – 20th March 2014. https://reliefweb.int/report/pakistan/nutrition-food-security-and-livelihood-emergency-tharparkar-district-sindh-province

Pakistan Water Partnership. 2014. Aide Memoire. Fact Finding Mission and Drought Master Planning Appraisal Mission. April 16– April 21, 2014. Tharparkar Drought. http://dms.iwmi.org/images/reports/Interactive%20Workshop%20on%20GWP-IWMI-WMO%20SADMS%20-%20Proceedings.pdf

Panhawar, F. 2014. *The Cultural Neglected Role of Rural Women in Sindh*. The Pakistan Spectator. TPS. https://www.sciencedirect.com/science/article/pii/S0277539517303710

Parasai, B.R &. Shrestha, A.J. 2006. *A Perspective on Climate Change and Gender in Nepal*. Research Gate.

Pakistan Agricultural Research Council (PARC). 2019. *Annual Report: 2017-18*. http://www.parc.gov.pk/files/parc_pk/2019/Annual%20Report/AnnuRepo_2017_18.pdf

Parvin. A. G &. Ahsan, R.S.M. 2013. *Impacts of Climate Change on Food Security of Rural Poor Women in Bangladesh*. Management of Environmental Quality; Bradford p.802- 814.

Pakistan Food Security Cluster. 2017. *Pre-Crisis Market Analysis: Goat Market System*. https://fscluster.org/sites/default/files/documents/pcma_goat_market_report-final_20170222.pdf

Pakistan Institute of Labor, Education & Research – Karachi. 2017. *Sindh Lands Reforms Movement.* https://piler.org.pk/wp-content/uploads/2017/03/Sindh-Land-Reforms-Movement.pdf

Prakash, Anjal, Chanda Gurung Goodrich, and Sreoshi Singh. *Informing Water Policies In South Asia.* London: Taylor & Francis Group, 2018.

Prescott, Jody M. *Armed Conflict, Women and Climate Change.* Milton: Routledge, 2018.

World Food Programme. 2018. *Prevalence of multidimensional poverty by district*. https://reliefweb.int/sites/reliefweb.int/files/resources/Climate_Risks_and_Food_Security_Analysis_December_2018.pdf

Provincial Assembly of Sindh, 2015. *The Sindh Commission on the Status of Women Act*. http://www.pas.gov.pk/index.php/acts/details/en/31/287

Provincial Disaster Management Authority. 2014. *Drought status, actions taken and future initiatives*. Sindh Coordination Meeting.

Rahman, Atta-ur-, Amir Nawaz Khan, and Rajib Shaw. *Disaster Risk Reduction Approaches In Pakistan.* Tokyo: Springer Japan, 2015. https://link.springer.com/book/10.1007/978-4-431-55369-4

Rahma Islamic Relief. 2015. Tharparkar. Situation Assessment. Annual Report. http://res.cloudinary.com/rahmapk/image/upload/v1493054672/Annual%20Reports/RAHMAPK_-_Annual_Report_2015.pdf

Rajan, S. Irudaya, and R. B Bhagat. *Climate Change, Vulnerability and Migration.* Milton: Taylor and Francis, 2017.

Raza, Ahmed and Khan, Daud. 2018. *Pakistan: Food Security and Reducing the Price of Wheat.* Inter Press Service News Agency. http://www.ipsnews.net/2018/12/pakistan-food-security-reducing-price-wheat/

Rupesinghe, Kumar, and Khawar Mumtaz. *Internal Conflicts In South Asia.* London: Sage, 1996.

Saeed, A. 2013. *Climate Change: Pakistan's Anti-Climatic Response*. Dawn News. https://reliefweb.int/report/pakistan/climate-change-pakistans-anti-climactic-response

Saeed, Fahad. 2016. *El Nino: a looming disaster.* thethirdpole.net. https://www.thethirdpole.net/en/2016/03/02/el-nino-a-looming-disaster/

Saeed, Basharat and Rukh, Harmain. 2017. *Loss & Damage from Drought in Pakistan: Notes from Tharparkar.* LEAD Paksitan. http://www.lead.org.pk/lead/Publications/Loss%20&%20Damage%20from%20Drought%20in%20Pakistan%20-%20Notes%20from%20Tharparkar.pdf

Samee, D., Nosheen, F., Khan, N.H., Khowaja, A.I., Jamali, K., Paracha, I.P., Akhtar, S., Batool, Z. & Khanum, Z. 2015. *Women in Agriculture in Pakistan*. Food and Agriculture Organization of the United Nations (FAO).

Samoon, Hanif. 2017. *Firm announces shutting down of 84 RO plants in Tharparkar. Dawn.* https://www.dawn.com/news/1319705

Sánchez-Triana, Ernesto, et al. *Sustainability and Poverty Alleviation: Confronting Environmental Threats In Sindh, Pakistan.* Washington, DC: World Bank, 2015. http://documents.worldbank.org/curated/en/356741467991965587/Sustainability-and-poverty-alleviation-Confronting-environmental-threats-in-Sindh-Pakistan

Sattar, Adnan. 2014. *Climate Change and Migration. Exploring the Linkage and what needs to be done in the context of Pakistan*. Lead Pakistan. Occasional Paper Series 29. https://www.ctc-n.org/resources/climate-change-and-migration-exploring-linkage-and-what-needs-be-done-context-pakistan

Satellite map of Pakistan. Maphill. ©2011 Maphill. http://www.maphill.com/pakistan/maps/satellite-map/

Shah, A. Shaheen. 2012. *Gender and building homes in disaster in Sindh, Pakistan, Gender & Development*. 20:2, 249-264. https://www.tandfonline.com/doi/abs/10.1080/13552074.2012.687222

Shah, A.I., Aziz, A. &. Ahmad, S.M. 2015. *Women Councilors for Women's Empowerment in Pakistan*. Journal of International Women's Studies, Vol.16(3), 203-219. http://vc.bridgew.edu/cgi/viewcontent.cgi?article=1823&context=jiws

Shah, A. Waseem. 2016. *Women's Commission needs to be made Autonomous and Effective*. Dawn News. https://www.dawn.com/news/1263053

Shah, Nafisa. *Honour and Violence: Gender, Power and Law In Southern Pakistan.* New York: Berghahn, 2016.

Shaikh, Sana F. 2014. *Internally displaced persons: citizens' rights in a world at the mercy of climate change*. Human Rights Review. https://uclhumanrightsreview.wordpress.com/volume-i-student-articles/internally-displaced-persons-citizens-rights-in-a-world-at-the-mercy-of-climate-change/

Shaikh, Saleem and Tunio, Sughra. 2014. *Slow response to famine claiming lives in Pakistan's Sindh province*. http://news.trust.org//item/20140314115423-0fxy2/

Shaikh, Z.K.E., Baghat, U.G. & Gill, F. 2015. *Comparative Analysis of Male and Female Education in Sindh Province of Pakistan*. Grassroots Vol.49, No.1.

Sharma, Akriti, 2016. *Climate Change Instability and Gender Vulnerability in Nepal: A Case Study on the Himalayan Region*. International Development, Community and Environment (IDCE). Paper 37

Shirkat Gah. 2011. *Climate Change and Women: A Study in Selected Sites in Rural Sindh, Pakistan*. http://climateinfo.pk/frontend/web/attachments/data-type/CLIMATE%20CHANGE%20AND%20WOMEN.pdf

Shutte, S. &. Kreutzmann, H. 2012. *Social Vulnerability in Sindh: Recent Floods as Amplifiers of Social Crisis in Pakistan*. Internationales Asienforum, Vol. 43. pp. 199–221

Sidhu, R.S., Singh, S., and Bhullar, A.S., 2011. *Farmers' Suicides in Punjab: A Census Survey of the Two Most Affected Districts*. Economic and Political Weekly. Vol. 46, No. 26/27, Supplement: Review of Agriculture, pp. 131-137. https://www.jstor.org/stable/23018817?seq=1#page_scan_tab_contents

*Sindh Drought Needs Assessment Report*. January 2019. Asian Preparedness Partnership. https://app.adpc.net/sites/default/files/public/publications/attachments/Sindh%20Drought%20Needs%20Assessment%20Report%20-%20January%2023%2C%202019.pdf

Singh, Surendra. *Politics of Regionalism In Pakistan: a Study of Sind Province.* Delhi: Kalinga Publications, 2003.

Skinner, Emmeline. 2011. *Gender and Climate Change*. Overview Report, Institute of Development Studies. https://gsdrc.org/document-library/gender-and-climate-change-overview-report/

Social Policy and Development Center (SPDC). 2012. *The State of Social Development in Rural Pakistan*, Annual Review, 2012-2013.

Social Policy and Development Center (SPDC). 2015. *Gender and Social Vulnerability to Climate Change: A study of Disaster Prone Areas in Sindh*. http://spdc.org.pk/Data/Publication/PDF/Final%20Consolidated%20Report%2004-03-15.pdf

Sogani, R. 2016. *Gender Approaches in Climate Compatible Development: Lessons from India*. Climate Development Knowledge Network (CDKN). http://cdkn.org/wpcontent/uploads/2016/05/CDKN_India-Gender_report_WEB.pdf

Sustainable Development Policy Institute. (2008). *Pakistan: Country Gender Profile*. https://www.jica.go.jp/pakistan/english/office/others/pdf/CGP_01.pdf

Suthar, V., Sarki, M.S., Qureshi, N.A., Solangi, B.K., and Mangan, T. 2016. *Factors triggering poverty in District Tharparkar Sindh, Pakistan*. Pak.J. Agri., April. Engg., Vet. Sci., 32 (2): 258-267. https://pdfs.semanticscholar.org/d4bc/81e89d1b5a417d21590d3ea3f80389350bcc.pdf

Swatuk, Larry, and Lars Wirkus. *Water, Climate Change and the Boomerang Effect: Unintentional Consequences for Resource Insecurity.* Milton: Routledge, 2018.

Tagar, K. Hamza. 2014. *Global Challenges and Issues in Agricultural Marketing and Their Impact on Growers Performance: A Case Study of Sindh –Pakistan*. International Journal of Innovative Research and Development. 314-318.

Taylor, Marcus. *The Political Ecology of Climate Change Adaptation: Livelihoods, Agrarian Change and the Conflicts of Development.* London: Routledge, 2015.

Terry, Geraldine, ed. 2009. *Climate Change and Gender Justice*. Rugby Oxfam GB. Practical Action Publishing. United Kingdom.

Thardeep Rural Development Programme (TRDP). 2014. *Situation Assessment on Drought*. Tharparkar and Umerkot. Monitoring and Evaluation Section. http://thardeep.org/thardeep/Publication/PubFiles/q0uk7hexboq2TRDP%20Report%20on%20Drought%20Assesement.pdf

Tortajada, Cecilia. 2016. *Increasing Resilience to Climate Variability and Change: The Roles of Infrastructure and Governance In the Context of Adaptation.* Singapore: Springer Singapore.

United Nations Development Programme (UNDP). *Fact Sheet: Women, Gender Equality and Climate Change*. The UN Internet Gateway on Gender Equality and Empowerment of Women. http://www.un.org/womenwatch/feature/climate_change/downloads/Women_and_Climate_Change_Factsheet.pdf

UNDP Pakistan. 2016. *Inequality: Missing from the Public Agenda*. Development Advocate, Pakistan, Volume 3, Issue 2. Islamabad, Pakistan. https://www.undp.org/content/dam/pakistan/docs/DevelopmentPolicy/DAP%20June%202016%20-%20English.pdf

United Nations Development Program. 2009. *Capacity Development: A UNDP Primer*. https://www.undp.org/content/dam/aplaws/publication/en/publications/capacity-development/capacity-development-a-undp-primer/CDG_PrimerReport_final_web.pdf

United Nations Development Programme. Human Development Report. Human Development Data (1990-2017). http://hdr.undp.org/en/data

United Nations Development Program. 2018a. *Human Development in Pakistan*. http://www.pk.undp.org/content/pakistan/en/home/blog/2018/human-development-in-pakistan.html

United Nations Development Program. 2018b. *Human Development Indices and Indicators: 2018 Statistical Update. Pakistan.* http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/PAK.pdf

UNESCO. 2017. *Community engagement and online literacy empower girls and women in Paksitan*. https://en.unesco.org/news/community-engagement-and-online-literacy-empower-girls-and-women-pakistan

UNFCC. 2012. *Private Sector Initiative Actions on Adaptation*. Database. https://unfccc.int/topics/resilience/resources/psi-database

UN Habitat. 2012. *A Guide on Land and Property Rights in Pakistan*. Pakistan Settlements flood Recovery Project. Second Edition. http://www.ndma.gov.pk/Publications/A%20Guide%20on%20Land%20and%20Property%20Rights%20in%20Pakistan%202012.pdf

United Nations Pakistan. 2014. *The predicament of governance: drought in Sindh province*. UNRCO Mission report 9 –11 December. One UN Programme II (2013 – 2017)

UN Women. 2015. *Climate Change and Migration in Bangladesh: A Gender Perspective*. https://www.climate-diplomacy.org/publications/climate-change-and-migration-bangladesh-gender-perspective

United Nations. *World Economic and Social Survey, 2016*. Chapter 2: Climate change and inequality nexus. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/2_Chapter_WESS2016.pdf

United Nations Department of Economic and Social Affairs. International Decade for Action 'WATER FOR LIFE' 2005-2015. *Gender and water*. Last updated October 2014. https://www.un.org/waterforlifedecade/gender.shtml

US AID. *Pakistan Emergency Situational Analysis: A Profile of District Tharparkar*. May 2014. https://reliefweb.int/sites/reliefweb.int/files/resources/PESA-DP-Tharparkar-Sindh.pdf

Verka. 2016. *Women Dairy Cooperative: Empowering the Women of Punjab.* http://www.verka.coop/blog/post/women-dairy-cooperatives-empowering-the-women-of-punjab

Verkaaik, Oskar. 2016. *Violence and Ethnic Identity Politics in Karachi and Hyderabad.* Partition and Sindh: Dispersals, Memories and Diasporas. South Asia: Journal of South Asian Studies. Volume 39, Issue 4. 841-854. https://www.tandfonline.com/doi/full/10.1080/00856401.2016.1228714

Waldren, Jacqueline, and Ignacy-Marek Kaminski. *Learning From the Children: Childhood, Culture and Identity In a Changing World.* New York: Berghahn Books, 2012.

Wang, S.Y., Davies, Robert, Gillies, Robert, and Jin, Jiming. 2011. *Changing Monsoon Extremes and Dynamics: Example in Pakistan*. Science and Technology Infusion Climate Bulletin. NOAA National Weather Service. 36th Annual Climate Diagnostics and Prediction Workshop. Fort Worth, TX. https://www.nws.noaa.gov/ost/climate/STIP/36CDPW/36cdpw-swang_orl.pdf

Warraich, Haider. 2011. *Pakistan's bubbling water crisis.* Foreign Press. https://foreignpolicy.com/2011/06/13/pakistans-bubbling-water-crisis/

Wasim, P. M., Herani, M.G., Farooqi, W. & Qureshi, M.A. 2008. *Family Types, Authority Structure and Women Workers in Sindh Labor Force: Problems and Prospects*. Indus Journal of Management and Social Sciences, Vol.2. 24-49. https://mpra.ub.uni-muenchen.de/8292/

Wassan Ali, A. 2011. *Gender Disparity in Sindh: A Sociological Analysis*. The Asian Conference on the Social Sciences Official Conference Proceedings, pp. 634-640.

Women Development Department, Government of Sindh. http://www.sindh.gov.pk/dpt/WDD/index.html

Women's Parliamentary Caucus Pakistan. http://www.wpcpk.org/

The World Bank. Data. 2011. UNESCO Institute for Statistics. Nepal. Literacy, adult female. https://data.worldbank.org/indicator/SE.ADT.LITR.FE.ZS?locations=NP&view=chart

World Bank. 2011. *Vulnerability, Risk Reduction and Adaptation to Climate Change*. Climate Risk and Country Profile Pakistan. World Health Organization, 2017. http://www.who.int/gender-equityrights/understanding/gender-definition/en/

World Bank. 2017. *Punjab - Gender (English)*. India state briefs. Washington, D.C. : World Bank Group. http://documents.worldbank.org/curated/en/392981504172754967/Punjab-Gender

World Economic Forum. *Global Gender Gap Report 2018.* Insight Report. http://www3.weforum.org/docs/WEF_GGGR_2018.pdf

World Food Programme. 2014. *Alert on Alarming Food Security and Nutrition situation*. Special Focus: Worsening Thar Drought. https://reliefweb.int/report/pakistan/daily-emergency-response-situational-information-report-6th-november-2014

World Food Programme. 2017. *Pakistan Food Security Bulletin, August 2017.* http://vam.wfp.org.pk/Publication/Pakistan_Food_Security_Bulletin_August_2017.pdf

World Health Organization, 2012. *Country Cooperation Strategy Plan for Pakistan: 2011-2017.* http://www.emro.who.int/images/stories/pakistan/documents/CCS_Pakistan_-_15_Feb_2012.pdf

Yin, K. Roberts. 1994. *Case Study Research Design and Methods*. Social Research Method Series, Chapters 1 & 2, Second Edition.

Young, William J., Anwar, Arif, Bhatti, Tousif, Brogomeo, Edoardo, Davis, Stephen, Garthwaite III, William R., Gilmont, Michael, Leb, Christina, Lytton, Lucy, Makin, Ian and Saeed, Basharat. 2019. *Pakistan: Getting More from Water*. The World Bank Group. http://documents.worldbank.org/curated/en/251191548275645649/pdf/133964-WP-PUBLIC-ADD-SERIES-22-1-2019-18-56-25-W.pdf

Yusuf, H. &. Hasan Shoaib, S. 2014. *Conflict Dynamics in Sindh*. United States Institute of Peace.

Zahra-Malik, Mehreen, 2018. *Pair of Killing Tests Hindu-Muslim Unity in a Pakistani Desert Town*. The New York Times. https://www.nytimes.com/2018/02/22/world/asia/pakistan-hindus-murders.html

Zaidi Y., Farooq S. et al. 2016. *Women's Economic Participation and Empowerment in Pakistan*. Status Report 2016. UN Women Pakistan. Islamabad. http://www2.unwomen.org/-/media/field%20office%20eseasia/docs/publications/2016/05/pk-wee-status-report-lowres.pdf?la=en&vs=5731